

572.5  
A 5  
756

# TRANSACTIONS

OF THE

# AMERICAN FISHERIES SOCIETY

AT ITS



*Twenty-ninth Annual Meeting*

JULY 18, 19 AND 20, 1900.

*Headquarters of the Meeting, United States Fish Commission Station,  
Woods Hole, Massachusetts.*

---

DETROIT:  
SPEAKER PRINTING CO.,  
1900.

#### OFFICERS FOR 1900-1901.

---

<i>President,</i>	F. B. DICKERSON, Detroit, Mich.
<i>Vice-President,</i>	GENERAL E. E. BRYANT, Madison, Wis.
<i>Treasurer,</i>	C. W. WILLARD, Westerly, R. I.
<i>Recording Secretary,</i>	SEYMOUR BOWER, Detroit, Mich.
<i>Corresponding Secretary,</i>	W. DE C. RAVENEL, Washington, D. C.

#### EXECUTIVE COMMITTEE.

---

FRANK N. CLARK, *Chairman*, Northville, Mich.

DR. B. W. JAMES, Philadelphia, Pa.

ROBERT HAMILTON, Greenwich, N. Y.

ALDEN SOLMANS, South Norwalk, Conn.

J. J. STRANAHAN, Bullochville, Ga.

NATHANIEL WENTWORTH, Hudson Centre, N. H.

HENRY O'MALLEY, Baker, Wash.

JAN 10 1921

TRANSACTIONS

American Fisheries  
Society

NINETEEN HUNDRED





## PREFACE.

---

As many into whose hands the Transactions will fall have little or no interest in such of the proceedings as relate solely to business matters and business procedure, it has seemed best to the Secretary to compile all transactions of a routine or incidental nature into one body as Part One, and the papers and discussions into a separate body as Part Two. It is believed that this plan will also facilitate reference and thus help to make the Transactions more acceptable to all.

380820



PART I

**BUSINESS SESSIONS.**



# Transactions of the American Fisheries Society.

---

*Wednesday, July 18, 1900.*

The meeting was called to order by President Titcomb at 10:30 a. m.

The following old and new members were in attendance at one or more of the sessions at Woods Hole and on the steamer Fish Hawk:

Name.	Address.
Bennett, S. R.....	New Bedford, Mass.
Bowers, George M.....	Washington, D. C.
Bower, Seymour.....	Detroit, Mich.
Brewster, C. E.....	Grand Rapids, Mich.
Bryant, Gen'l E. E.....	Madison, Wis.
Bumpus, Dr. H. C.....	Providence, R. I.
Clark, Frank N.....	Northville, Mich.
Corliss, C. S.....	Gloucester, Miss.
Davis, H. W.....	Grand Rapids, Mich.
Dickerson, F. B.....	Detroit, Mich.
Dinsmore, A. H.....	Green Lake, Maine.
Edwards, Vinal N.....	Woods Hole, Mass.
Geer, E. H.....	Hadlyme, Conn.
Hahn, Capt. E. E.....	Woods Hole, Mass.
Hamilton, Robert.....	Greenwich, N. Y.
Handy, L. B.....	South Wareham, Mass.
Hubbard, Waldo F.....	Nashua, N. H.
Huntington, L. D.....	New Rochelle, N. Y.
Hurlbut, H. F.....	East Freetown, Mass.
James, Dr. Bushrod W.....	Philadelphia, Pa.
Jennings, G. E.....	New York City.
Lane, G. F.....	Silver Lake, Mass.

Locke, E. F.....	Woods Hole, Mass.
Mathewson, Geo. T.....	Thompsonville, Conn.
Mead, Prof. A. D.....	Providence, R. I.
Milliken, Dr. J. D.....	Woods Hole, Mass.
Morse, Grant M.....	Portland, Mich.
Nevin, James.....	Madison, Wis.
O'Malley, Henry.....	Baker, Washington.
Peabody, Geo. F.....	Appleton, Wis.
Proctor, Redfield.....	U. S. Senator, Vermont.
Ravenel, W. de C.....	Washington, D. C.
Root, Henry T.....	Providence, R. I.
Smith, Dr. H. M.....	Washington, D. C.
Smith, Capt. J. A.....	Woods Hole, Mass.
Thompson, W. T.....	Nashua, N. H.
Titcomb, John W.....	St. Johnsbury, Vt.
Wentworth, Nathaniel.....	Hudson Centre, N. H.
Willard, C. W.....	Westerly, R. I.
Wood, C. C.....	Plymouth, Mass.

During the several sessions the following gentlemen were elected to membership in the Society:

Name.	Address.
Adams, Fred J.....	Grand Rapids, Mich.
Ainsworth, C. E.....	Sault Ste. Marie, Mich.
Allen, G. R.....	Roxbury, Vt.
Andrews, A.....	Columbus, Ga.
Bailey, H. W.....	Newbury, Vt.
Bennett, S. R.....	New Bedford, Mass.
Blatchford, E. W.....	Chicago, Ill.
Boyce, F. C.....	Carson City, Nev.
Brewster, C. E.....	Grand Rapids, Mich.
Brewster, W. K.....	Durand, Mich.
Bullard, C. G.....	Kalamazoo, Mich.
Chambers, A. E.....	Kalamazoo, Mich.
Chase, H. C.....	Philadelphia, Pa.
Collins, J. C.....	Providence, R. I.

Carlo, G. Postiglione de.....	Naples, Italy.
Cobb, E. W.....	St. Johnsbury, Vt.
Cogswell, J. M.....	Washington, D. C.
Cohen, N. H.....	Urbana, Ill.
Corliss, C. S.....	Gloucester, Mass.
Coulter, A. S.....	Charlevoix, Mich.
Dunlap, I. H.....	Washington, D. C.
Edwards, Vinal N.....	Woods Hole, Mass.
Fearing, D. B.....	Newport, R. I.
Geer, E. H.....	Hadlyme, Conn.
Greene, Myron.....	Franklin, Vt.
Hahn, E. E.....	Woods Hole, Mass.
Hamsdale, Frank.....	Madison, Wis.
Hogan, J. J.....	Madison, Wis.
Handy, L. B.....	South Wareham, Mass.
Hoxie, Chas. A.....	Carolina, R. I.
Hubbard, W. F.....	Nashua, N. H.
Hughes, Frank L.....	Ashland, N. H.
Jensen, Peter.....	Escanaba, Mich.
Joseph, D.....	Columbus, Ga.
Kenyon, A. W.....	Usquepang, R. I.
Lamkin, J. Bayard.....	Bullochville, Ga.
Lane, Geo. F.....	Silver Lake, Mass.
Lawton, J. P.....	Columbus, Ga.
Locke, E. F.....	Woods Hole, Mass.
Lovejoy, Samuel.....	Bullochville, Ga.
Mathewson, G. T.....	Thompsonville, Conn.
Mead, A. D.....	Providence, R. I.
Milliken, J. D.....	Woods Hole, Mass.
O'Connor, E. M.....	Savannah, Ga.
O'Malley, Henry.....	Baker, Washington.
Peck, Stephen.....	Warren, R. I.
Proctor, Redfield.....	Proctor, Vt.
Robinson, A. H.....	St. Johnsbury, Vt.
Rodgers, Frank A.....	Grand Rapids, Mich.
Self, E. M.....	Bullochville, Ga.
Schweikart, Walter.....	Detroit, Mich.

Sellers, M. G. ....	Philadelphia, Pa.
Solmans, Alden. ....	South Norwalk, Conn.
Starr, W. J. ....	Eau Claire, Wis.
Sykes, Arthur. ....	Madison, Wis.
Seagle, G. A. ....	Wytheville, Va.
Smith, H. M. ....	Washington, D. C.
Smith, J. A. ....	Woods Hole, Mass.
Stewart, Chas. E. ....	Westerly, R. I.
Thompson, W. P. ....	Philadelphia, Pa.
Thompson, W. T. ....	Nashua, N. H.
Tinker, E. F. ....	St. Johnsbury, Vt.
Trumpour, D. A. ....	Bay City, Mich.
Tucker, E. St. George. ....	Halifax, N. S.
Vincent, W. S. ....	Leadville, Colo.
Vogelsang, A. F. ....	San Francisco, Cal.
Wentworth, Nathaniel. ....	Hudson Centre, N. H.
Wilbur, P. H. ....	Little Compton, R. I.

The President: Gentlemen, you have not assembled here to listen to an inaugural address, and I am going to detain you but a few minutes, in assuming the honor of presiding over your deliberations during this convention. As the duties of the President have been established by custom rather than by the Constitution, the work of presiding at the annual meeting is about all that you will expect of me.

I have conducted more or less correspondence during the year in attempting to keep up and increase the membership of the society. In this work I have had the hearty support of your efficient Secretary. In looking over the printed transactions for the past ten years I find that the highest number of members were enrolled in 1894, there being on the books at that time 267. Undoubtedly many of that list were not paying members, and the records of 1896 indicate that many were weeded out, the total number enrolled being only 146. Since 1896 the membership has been gradually increasing until today we have recorded on our books 204 names, besides the ones to be proposed at this meeting. Of the 204 names, 20 are not regularly members until



the action of your President and Secretary has been ratified. After the last annual meeting we sent out a circular letter addressed to all State Fish Commissioners not already members, and to all others whom we thought ought to be members. The twenty who responded paid their dues as of last year, and received the literature of the Society as regular members. I understand that the present membership list is all an active one, the delinquent members having all been dropped last year.

The call for the present meeting has been sent to all Governors of States, requesting that delegates from their Fish Commissions be sent to the meeting. I do not quite understand why we do not have more members from State Fish Commissions, inasmuch as the reports of the transactions of the Society are worth much more than the annual membership fee to all enterprising and progressive Fish Commissioners. Perhaps I may mention the additional profit from personal intercourse and comparison of notes by the members who are able to attend the annual meetings; while we learn much from the papers and their discussion, I find that on special subjects we learn much more by personal contact with others interested in similar lines of work. It appears, however, that we cannot secure new members very rapidly except by personal solicitation, and to that end I urge all members to think over the list of eligible members in their respective States, and then induce these eligibles to join the Society.

As we have an unusually large number of papers to be read and discussed, I will endeavor to dispatch the routine business as rapidly as possible.

The first business before the meeting would perhaps be the reading of the Secretary's report, but I would suggest that inasmuch as we have present with us some would-be members, that we immediately act upon the applications for membership before doing any further business, and to that end I will ask you to file applications for membership. I will change that order a little, and suggest first that you propose a temporary treasurer in

the absence of the regular treasurer.\* I understand that Mr. Huntington will not be here until later.

On motion, Mr. H. W. Davis was elected to act as temporary treasurer.

The President: In connection with the applications for membership I will say that last year we took in, under the circular that you received, 20 members. I will ask the Secretary to read the names of those taken in by the President and Secretary for your ratification.

After the reading of the names, a motion declaring the gentlemen duly elected as members of the Society, was unanimously carried. These names, together with all others presented and elected during the several sessions, are included in the list printed elsewhere in the transactions.

On call of President Titcomb, the Secretary then read the following report:

REPORT OF THE RECORDING SECRETARY.

*To the Members of the American Fisheries Society:*

GENTLEMEN: Since the last annual meeting, four circulars have been issued, three for mailing to the members and to others who might be induced to become members, and one for mailing to the Governors of the States. The text for these circulars was prepared, for the most part, by President Titcomb. I am also indebted to the President for assistance and favors in many other ways, rendering the duties of the Secretary less onerous to that extent, and for all of which grateful acknowledgment is hereby tendered. I desire to add that the thanks of every member are due to the President for the zeal and tireless energy he has displayed at all times in furthering the interests of the Society.

The correspondence during the past year has been quite voluminous. Owing to absence from home a considerable portion of the time, it has been impossible for me to attend to the business that arose as promptly as might be desired, for which

I ask the indulgence of the members. I also crave the indulgence of some of the Western members for taxing their patience with persistent personal appeals for contributions for this meeting, the Eastern members being left to the tender mercies of the President.

The active membership list as furnished by the Treasurer, and published in the report for 1899, contains 184 names, a net gain of 28 over the preceding year. A noticeable feature in connection with the published list is the date of admission to membership, so far as this could be ascertained by the Treasurer. I suggest to members who may have knowledge of the missing dates that they communicate with the Treasurer at their earliest convenience.

I am unable to state the exact number of names that were dropped this year for non-payment of dues; nor have I the data showing the number of resignations and deaths. Conspicuous in the list of the latter are the names of Col. Fred Mather and Herschel Whitaker, the former one of the founders of the Society, the latter an ex-President and ex-Secretary, and both widely known through their contributions to the literature of fish-cultural and kindred subjects, and I suggest that suitable action thereon be taken by the Society.

The report for 1899 was printed at the lowest competitive bid, 75 cents per page for 500 copies, or eight cents less per page than the report for 1898, bringing the cost of the entire edition for 1899 below \$100. These reports were not completed and ready for mailing until early in December, the issue being delayed in part by my absence from headquarters for days and weeks at a time, and for other reasons.

Partly through the advice of the President, and partly on my own judgment, a more liberal policy in the matter of distributing reports has been adopted. Of the edition for 1899, 434 copies have been disposed of, leaving 66 on hand. I have also distributed about 100 copies of back reports to members, on application.

I herewith submit an inventory of the reports in my hands at the present time:

Year.	Number of Copies.
1892.....	1
1893.....	6
1894.....	13
1895.....	124
1896.....	143
1897.....	200
1898.....	191
1899.....	66
Total .....	744 copies.

During the year I have received 23 applications for membership, accompanied with the regular membership fee. July 12th I forwarded to the Treasurer a certified statement of all funds received and disbursed by me for the Society up to and including that date.

Respectfully submitted,

SEYMOUR BOWER,

Recording Secretary.

On motion the report of the Secretary was accepted and adopted.

The President: The next business in order naturally would be the reading of the Treasurer's report, but this will have to be suspended until his arrival. The next will be the Corresponding Secretary's report.

#### REPORT OF CORRESPONDING SECRETARY.

The correspondence during the year has been mostly with editors of magazines, newspapers, and members of the Society. Foreign correspondence sought for nothing new. Quite a number of letters received suggesting that we take some action thanking eastern societies for their success in checking the killing of our song birds.

Several members suggest that the United States Fish Commission should have national distributing points for the collection of small fish for distribution in our inland streams. Some of our eastern members ask if our United States Fish Commission could bring to America a few of the very desirable fish found in the island streams of Cuba, Philippines and other new possessions.

A question is asked by one of our leading State Fish Commissioners: "Why is it that our State Fish and Game Commissioners do not take a greater interest in this Society? Each State should be in close touch with the American Fisheries' Society through their Fish and Game Commissioners. No trouble to get recognition from legislative authority if properly pushed."

All letters have been promptly answered.

J. E. GUNCKEL,  
Corresponding Secretary.

On motion the report of the Corresponding Secretary was accepted and adopted.

President Titcomb: At any time during this meeting I will suggest that if there are any errors in the printed report of the transactions of the Society last year, as noticed by any members—any errors in addresses or changes in addresses, that they be brought to the attention of the Secretary.

It is customary to appoint some committees, and your Secretary has recommended that a Committee on Resolutions be appointed. What action will you take on that?

On motion of Mr. James, the President was authorized to appoint a committee of three, and the following gentlemen were named:

COMMITTEE ON RESOLUTIONS.

Dr. B. W. James, of Pennsylvania.  
G. F. Peabody, of Wisconsin.  
H. W. Davis, of Michigan.

The President: The next business in order will be the

nomination of officers for the ensuing year. What action will you take?

On motion of Mr. Clark, the President was instructed to appoint a nominating committee of five, and the following gentlemen were named:

COMMITTEE ON NOMINATIONS OF OFFICERS.

Frank N. Clark, of Michigan.

Dr. H. C. Bumpus, of Rhode Island.

George F. Peabody, of Wisconsin.

W. de C. Ravenel, of Washington, D. C.

Nathaniel Wentworth, of New Hampshire.

President Titcomb: I would suggest to the committee that perhaps they will wish, before making their report, to wait until more members have arrived. We shall have today members from other States, and quite a number are expected; I know all three of the Commissioners from Connecticut are coming. I suggest that perhaps we ought to get through with as much business of this kind as possible, so that we can give our time to the papers. It is customary to appoint a committee on time and place for the next meeting.

On motion, the Chair was instructed to appoint three members to act as such committee. The names were not announced at the time, but later the following gentlemen were appointed:

COMMITTEE ON TIME AND PLACE OF NEXT MEETING.

Henry T. Root, of Rhode Island.

Grant M. Morse, of Michigan.

Dr. B. W. James, of Pennsylvania.

President Titcomb: Are there any reports from committees of last year?

The Secretary: None.

The President: Perhaps it would be well to take up at this

time, in connection with the program of the Society and the work before us, the part that relates to recreation. I find that we can hold meetings very conveniently on either the Grampus or Fish Hawk and read our papers at the same time. It was suggested in this program that a visit be made to one or more of the commercial trout hatcheries, and I have had correspondence with Mr. Wood, the superintendent of the hatchery at Plymouth, and Mr. Hurlburt of East Freetown. Mr. Wood holds forth a very attractive program for us, but I am going to be perfectly candid and present the drawbacks to all. The visit to Plymouth will give you an opportunity to visit three or four hatcheries, but it will be a three or four hours' trip on the cars, and those that have just come from Boston will probably not care to go through that torrid atmosphere again. Mr. Hurlburt has a hatchery eight miles from New Bedford. We can take the Fish Hawk and read papers on board the boat, arriving at New Bedford in about an hour and a half, and take an electric car to East Freetown, and then have a 13 minutes' walk through the woods to his hatchery. There you can see a typical hatchery for raising trout for the market, where they do business for what there is in it, and we can have an electric car to ourselves to go up and return. We can then have dinner at New Bedford. The only expense for the trip will be for this dinner, which we can arrange for beforehand as soon as we know how many will go. Possibly there are other representatives of commercial hatcheries here who would like to present invitations, and before this is acted upon I would inquire if there are any such.

The Secretary: I want to say that I have received a very cordial invitation from Mr. Handy, of South Wareham, to visit his hatchery. I supposed I had his letter here, but I must have mislaid it. Mr. Handy is here and perhaps will speak for himself.

Mr. Handy: You can leave here at 2:20 and arrive at South Wareham at 3:20, and I will then take you over to my place. You can leave there at 6:38, and arrive here in an hour; a short trip. I have a commercial hatchery, 75,000 two and three-year-

old trout, and possibly as many more fry, and I guess I have the longest stretch of ponds of anybody in the State, probably not the largest stream of water. I will make all arrangements to get you to the hatchery and back to the station, and you will have three hours at the hatchery.

The President: I would suggest, to save time and to get this matter in shape, that a committee of three might properly be appointed, for any further representatives to present the conditions of getting back and forth, and without further action I will take it as your pleasure to appoint such a committee. I will appoint Mr. Dickerson, Mr. Nevin and Mr. O'Malley, and request that they meet and report as soon after dinner as possible. Are there any other matters to come up?

Dr. Bushrod W. James: I understand there is to be an international meeting of the fisheries interests in Paris this year during the exposition. The matter came before our Society in Pennsylvania, and one of our members, Mr. B. L. Douredoure, was to be there about the time of the meeting—I think the early part of next month—and we appointed him as our delegate from Pennsylvania, or our Society did at least, as the representative of the Society at that meeting. He was to let me know, and I am waiting for a letter from him now. He is probably in Paris long before this. I think it would be well if this Society would appoint any one that is over there, a representative at that meeting. I make a motion to that effect.

The President: You have heard the motion; are there any remarks?

Mr. Clark: Mr. Chairman, I would call attention to the fact that at the Omaha meeting Mr. Whitaker, Prof. Birge and myself were appointed delegates to that congress, but of course I do not expect to go.

The President: By this Society?

Mr. Clark: By this Society. Of course I call attention to it not on my own account, because I do not expect to go. I do not know what provision Prof. Birge has made, but Mr. Whitaker is gone. I would very much like to see the Society



represented. I would not hold by the action taken at Omaha, and now move to amend the motion in such a way as to add to the committee Mr. Douredoure and other members who may be in Paris.

General Bryant: Professor Birge, of Wisconsin, will not be able to attend.

Dr. James: I will accept the amendment of Mr. Clark.

The President: You have heard the motion as amended, and the amendment has been accepted, that Mr. Douredoure or any other members of this Society who may be present in Paris during the International Fisheries Congress, be added to the committee appointed at Omaha to attend this congress.

Motion carried.

The President: I did not think, when I suggested that the committee on entertainment meet after dinner to report, that it is rather desirable for the members representing commercial hatcheries to know as early as possible in order that they may make arrangements at the other end. I suggest that the committee meet such representatives on the piazza and decide at once what trip we will take, so we can act on it right here. Have you any other business at this present time? If not, I have another matter to present. It was suggested by one of the members who joined the Society today, that we have a provision for life membership. A great many people object to paying one dollar a year; they will neglect paying one dollar a year much more quickly than if it were \$10. It seems to me that we could amend the constitution, and I see that we can do so by a two-thirds vote. I will read article 2 of the constitution. I was going to suggest that it might be proper to add this to article 2 as section 2, which shall read:

"Any person shall, upon a two-thirds vote, and the payment of \$15.00, become a life member of this Society, and shall thereafter be exempt from all annual dues."

Mr. Clark: I move that the constitution be amended as suggested by the President.

The President: Gentlemen, it has been moved that article 2 of the constitution be amended by adding section 2, to read as follows: "Any person shall, upon a two-thirds vote, and the payment of \$15.00, become a life member of this Society, and shall thereafter be exempt from all annual dues."

Mr. Davis: Do the words "a two-thirds vote" apply to all the members, or only to those present.

The President: I think it would intend to mean a two-thirds vote of the members present. The constitution is vague, but the wording is the same as in the original section. Is there any discussion as to the amount of this life membership fee?

Mr. Clark: I see only one difficulty that is likely to arise. With a fee as small as that, it is barely possible that within the next year or two one-half the members might conclude to become life members; they might say, it is such a bother to pay every year. I will become a life member by paying fifteen dollars, and they pay it. We would be pretty flush for a year or two, and we would do something with that money, and then we would not have our annual dues to fall back on. There is a difficulty that may present itself. May be I am crossing a bridge before I come to it. I am not so sure but I might be one of those, when I had fifteen dollars I didn't want to use right off, to pay for a life membership. There is the one difficulty, it seems to me, if you make the life fee as low as that.

Mr. Morse: Mr. President, I think this is a very good idea. I think it would be an incentive to life members to induce new members to join in order to keep up the Society.

Resolution adopted.

The President: I have here a letter from Dr. R. O. Sweeny, of Duluth, one of the old members of the Society, who has been an officer at times and contributed papers.

The Secretary: Doctor Sweeny is one of the pioneer fish-culturists of this country, and for many years was one of the most active and prominent members of this Society. I think we should recognize his worth and ability by making him an honorary member for life. I make that as a motion. I know of no one

who so well deserves this distinction, and would like to hear from some of the older members who are acquainted with the doctor.

Dr. James: I will second that motion. Mr. Sweeny has done good work in the Society, and we can only honor ourselves and him by electing him an honorary member.

Mr. Clark: I would like to add a word for the good Doctor. I have known him and in connection with this Society for a good many years. I think I met Dr. Sweeny at the meetings of this Society twenty years ago; he was a very active member, and a man that has done a great deal for fish-culture and for this Society. I think the Society will be doing a noble act to honor him in this way.

Motion unanimously carried.

In reply to a notice of the action taken by the Society, Dr. Sweeny wrote as follows to the Secretary:

"I am very much gratified by your letter, announcing the great and unexpected honor of my election to honorary life-membership, conferred upon me by the American Fisheries Society at the Woods Hole meeting. Convey to the members my sincere regards and thanks for the compliment, which I greatly appreciate, and shall ever prize as one of the kindest I have ever received from my many friends, and I thank yourself for the kind remembrance of me in my old days and retirement from activity in the great work in which you are engaged, and in which I have been so many years greatly and actively interested.

"My health is such now that I keep close at home, and although there is a trout stream almost at my door, I am seldom in condition to scramble along its shores as I would dearly love.

"Believe me I am deeply touched by the kindly action of the dear old friends and members of the Society, and again thank you, one and all, and wish you success in your good work, and that luck will attend every cast, and that you may always come home happy and with full creels of finny spoil."

REPORT OF THE COMMITTEE ON RECREATION.

Mr. Dickerson: We have decided that owing to the fact

that we can go ahead with our meeting\* on the boat, the better way will be to go to New Bedford and visit the hatchery near there; then if by tomorrow night we find we are going to have time to go to Plymouth and visit those hatcheries, that is a matter that can be acted upon later. I desire to say in this connection that the superintendent of the Michigan hatcheries is going to visit a number of hatcheries, and I believe he will derive a great deal of benefit from it. I think it is to the advantage of the Society to encourage visits to these hatcheries. Mr. Nevin states that he is going to visit a number of them, so that representatives will visit many of the hatcheries anyway, whether we do as a body or not. Our report is, that we go to East Freetown via New Bedford.

On motion, the report of the committee was adopted.

The President: We will leave here at 8:30 tomorrow morning on the steamer Fish Hawk for New Bedford. I would say that the Rhode Island Fish Commissioners have cordially invited the Society to be their guests at a Rhode Island clam-bake at Oyster Bay, and to make an investigation of the oyster beds. It has been suggested by Dr. Bumpus that Friday be devoted to this purpose, and we can read the papers, if any are left to read, on that day, on board the Fish Hawk.

What action will you take, gentlemen, in reference to that invitation? It was thought that many might wish to go home direct from Providence. The steamer will go to Providence, so that many of you can get home from there earlier than from here.

On motion of Mr. Peabody, the invitation of the Rhode Island Fish Commission was accepted.

The President: We have a little more detail business to come before the meeting. I have here a communication from Mr. Charles B. Reynolds, the editor of the "Forest & Stream," New York. I wrote Mr. Reynolds in reply to this letter that there were two sides to the question, that with a fee of only one dollar it seemed as if all persons interested in fish-culture ought

to be willing to pay one dollar in order to receive the papers read at these meetings, and that I should present this matter to the Society for consideration. I would like to hear it discussed.

Dr. James: It seems to me after a paper is read and is public property that any journal might have the privilege of publishing it. I hardly feel that they should have all the papers presented, as we shall want them for our volume. Anyone that has an extra copy should have the privilege of printing it in such papers as he chooses. After they are read they are the property of this Society, but not before.

The President: I think it has been the custom of this Society to give the papers out. The Society feels that after the original papers have been presented here and read they are our property, but there has never been any objection by the Society against individual members loaning them to any journal. Are there any further remarks in reference to this letter of Mr. Reynolds?

Mr. Clark: Why is it necessary for us to take any action in the matter at all? It seems to me if it has been the custom for any member to turn over a copy of his papers to the *Forest and Stream*, that he may continue to do so.

The President: Why not make a motion that the members are at liberty to furnish their papers to the *Forest & Stream* if they see fit.

Mr. Clark: I then move that the Secretary be instructed to notify Mr. Reynolds to that effect.

The President: You have heard the motion that the Secretary be instructed to notify Mr. Reynolds, in reply to his letter, that the individual members may furnish duplicate copies of their papers to the *Forest & Stream*, the Society to retain the originals as its own property.

Mr. Morse: As I understand your statement of the motion, the individual members may present him duplicate copies. I think it ought to be so arranged that other publications could get the papers, too. I would make it so broad that the authors may give copies to any publication that they see fit.

The President: As I understand the motion, it is the sentiment of the Society that members furnishing papers are at liberty to furnish duplicates to any paper; that the Secretary be instructed to inform Mr. Reynolds and other papers to this effect. I would ask that the originals be considered the property of this Society.

Mr. Clark: I cannot help calling the attention of the members to one thing in this connection. Fifteen or eighteen years ago this same question was agitated in this Society. At that time the *Forest & Stream* had what might be called a cinch on the papers. Our deceased member, Fred Mather, was connected with that publication, and that went along for a year or two; then we gave our papers to the *American Field*, the *Forest & Stream*, and I don't know but one other publication. That went along for a time until a number were grabbing for the papers, and I don't know, but it seems to me we are going to land just where we did fifteen or twenty years ago. It was then decided that the best thing to do was simply not to give them to any publication; anyone that wanted them must join the Society. Now, if we are not a little careful we are going to drift into that same trouble. We had two or three sessions that were very warm over this same question. It was said then that the papers ought really to go to the public. I admit that they are for the purpose of instructing the people in the lines of our work, but I fear you will have some trouble on the start.

Mr. Davis: I heartily concur in the remarks of Mr. Clark; the articles presented here are valuable, they are very valuable, and many are anxious to get them. I have had letters and applications for them from a great many, but it strikes me that the public is not entitled to these publications unless they pay for them. We pay for them and spend our time, the members prepare these articles and they are valuable, and I do not know why they should be given gratuitously to all the papers; they can get all the proceedings here, the gist of them, through the newspaper reports of the meeting.

Mr. Ravenel: We simply leave it optional with the author.

Dr. James: Quite a large society that I am a member of had the same question before it not many years ago, and we found it necessary to limit it so that after a paper was read and discussed in the society the author was allowed to do what he pleased with it. There were some twenty or thirty journals interested in our meetings, and they were all looking for the papers from that organization, and so the fishing journals want to have these papers, and I see no reason why the people should not read these articles. It is claimed that many will not attend the meetings of the Society because they see the articles in the papers. I should think that would be just the thing to induce them to join, as it will whet their desire to become members rather than keep them waiting to get all the transactions in one mass. It simply resolves itself down to this point, whether we shall allow the journals to write to the members, or whether this Society shall definitely fix that no one shall have any of the papers until our report is out. I am quite liberal in this matter, however, and I think no journal should be made the special authority of this Society for the exclusive use of its members, as seems to have been the case some few years ago. I think all the journals should have access to all the papers from their authors as soon after the meeting is over as possible.

The Secretary: I think the objection raised by Mr. Clark could easily be overcome by the Secretary notifying such papers as are likely to want the articles—there are not over half a dozen of them—that the Society had granted the privilege to members to give out their papers as individuals. But there is another point to be considered. If a member does not retain a copy of his paper exactly as it is presented here, and some do not, how can he furnish a copy of it after it has been read here and turned over to our Secretary?

Mr. Dickerson: It is my understanding that there is no objection to the members furnishing copies of their papers, but the Society should hold the originals; that will cover the whole point and obviate the necessity for any motion. I think there is really no objection to this plan; in fact, we have nothing

to do with it anyway. Of course, no member would desire to give out his paper if he thought there was any objection by the Society.

Mr. Wood: Through courtesy to the Society.

Mr. Bryant: Wouldn't it be well to add that "he is at liberty after the paper has been read before this Society"?

Dr. James: As I said, after the papers were read in this Society. The circular sent out before each meeting gives a list of the papers to be read and the topics. Now, these publications might immediately correspond with the author and request a copy, and if they get the copy in advance they would very likely publish it before it was read here.

Mr. Davis: I think when a member has prepared a paper to be read before this Society, if he should furnish a copy in advance to a newspaper, the Society would hardly permit it to be read here. Papers should not be published until after they are read here.

Mr. Wood: Wouldn't it be a good plan to suggest to the *Forest & Stream* to correspond with the members?

Mr. Clark: I still insist that it does not seem to me we are going at this thing right. Before a paper is presented here it does not belong to this Society, and no one has a right to publish it as a paper read at a meeting of the Society. If the members think it is best to give them out after a meeting, let the Secretary be instructed to notify all the leading fishing journals that they are at liberty to have these papers by paying the expense of a typewritten copy. If it is to be done at all, let the Society do it and notify the *Forest & Stream* that they are at liberty to have all the papers; *American Field* and others the same, and if it is in order I move to amend so as to direct the Secretary to furnish typewritten copies to all the leading fish journals requesting a copy, such journals to pay the expense of the typewritten copy.

Dr. James: Would that allow the author to send two or more copies? A member might send two copies to the Secretary, who might select one or the other; it is then upon the Secre-



tary whether he shall send to the *Forest & Stream* or some other publication.

Mr. Clark: My idea is, that the Secretary should write to such journals and tell them that they can have any of the papers of the Society by paying for a typewritten copy.

Dr. James: My idea is, whether the author shall furnish several copies or only his own individual copy. He might furnish two copies, and in that case it would only go to one journal. The author might make journal duplicates himself.

Mr. Clark: The author should have nothing to do with it, should not control it after it comes here and becomes the property of the Society. But if one journal is allowed to have the papers, all should have the same privilege; they should be furnished by the Society, not by the authors.

Mr. Ravenel: What do we gain by that? We only add to the work of the Secretary, which is already a labor of love and not pay, and we compel the Society to do this when I thought it was the feeling to leave it optional with the authors.

The President: If you will excuse the Chair, I would like to say a word on this subject. Undoubtedly some members of this Society want their papers published. It has been customary for some of them to give their papers to different journals; I know I have given my paper to the *Fishing Gazette*. I always make my own copy in duplicate. It seems to me as to this I am ready to do, personally, whatever the Society wishes, but I do not think we can control any member as to his paper. He reads his paper here, and then if he chooses to give it to any journal it is his own business. We have his original, and if he chooses to give a copy of his paper to any journal we cannot control it; he has a right to do so; it is not copyrighted. It seems to me that the present resolution governs that point.

Mr. Bryant: Suppose Mr. Nevin writes a paper, and half a dozen newspapers in his State would like to publish it, and they make a request to him for it. The resolution as proposed, it seems to me, is more liberal than the amendment, which would compel them to apply to the Secretary and pay for a copy. That

would tend to turn everything into the leading fish journals, instead of leaving the author at liberty to get a little more publicity.

The Chair then put the question on the amendment of Mr. Clark, which was lost by a close vote. The original motion was then carried.

The President: I have been informed that Mr. Wood, Superintendent of the Plymouth Rock Trout Co., is ready to read his paper and desires to give it this afternoon, and I take it to be your pleasure that his be the first paper to be read.

I am happy to say that our Treasurer has arrived and will soon be ready to present his report.

I would like to inquire if there are any other members who would like to have their papers put ahead of others, that is, who are desirous of getting off early; this inquiry can be answered at any time, either to me or to the Secretary during the day, so that the work will run along as rapidly as possible.

Is there any further business before this meeting? I want to dispose of one more matter. The Secretary informs us he has a lot of back copies of our annual reports. They are valuable and we have applications for them from new members and others. I suppose it is simply a question of whether we give them away to those who come in at the eleventh hour or have them pay for the actual cost of the publication. Our treasury is not very flush with the present annual dues of only one dollar a year.

The Secretary: The plan that I have followed during the past year was to send out the reports, as far as I could, to any member of the Society who applied for them. The reports of '92 are practically exhausted. In some cases I prepaid the postage and sometimes when the package was large I sent by express, charges collect. I think in that way there were over 100 back reports disposed of during the past year. I think if it were generally understood that these reports are available they would be more generally applied for.

Mr. Clark: I would like to ask if it is understood that a

member may have a copy for each of the different years, if that is the idea?

The President: It is for this Society to decide how to dispose of them.

Mr. Huntington: Mr. Chairman, I would ask for information if there are back copies of all the respective years, or how far back, and for what years there are copies now in the hands of the Secretary?

(Secretary's report in reference to the above read again.)

The Secretary: I think, Mr. President, that at least five copies, where we have five copies, should be reserved and kept as the property of the Society.

The President: Some of you make a motion to dispose of this question. It seems to me that members who wanted to complete their sets would be ready to pay for them, and new members would be ready to buy their copies.

Mr. Dickerson: I would suggest that the copies be held for new members, and that they be given to new members gratuitously.

The President: Any further discussion of this question, if not, it seems to be left just where it was before. The new members will get them.

Mr. Davis: I make a motion that the new members—including my friend Brewster—be charged 25 cents a copy for all back reports that they call for and receive, and that the old members get them at the same price.

Motion seconded and carried.

On motion of the Secretary, it was ordered that five copies be reserved for the Society and that no issue be sold or disposed of below that number.

Mr. Davis: What is the expense of publishing?

The Secretary: The last reports cost, approximately, 20 cents a piece.

Adjourned until 2 p. m.

*Twenty-ninth Annual Meeting*

## AFTERNOON SESSION, WEDNESDAY, JULY 18.

Called to order by President Titcomb at 2:15.

This session was devoted to the reading and discussion, in order, of papers by Mr. Wood, Mr. Brewster and Dr. Bartlett.

Adjourned at 4:20 for a sail on the Grampus. No papers were read nor business transacted on the Grampus.

## EVENING SESSION, WEDNESDAY, JULY 18.

Called to order by the President at 8:15. The President announced that annual dues were due and payable and that the Treasurer was ready to receive them, also invited proposals for membership. Eight names were handed in and the gentlemen were duly elected as members of the Society.

The President: Shall we proceed with the reading of the papers or take up the detailed business now?

Mr. Ravenel: I would like to say that I will represent the United States Fish Commission at the Pan-American Exposition. Last year I called the attention of the State Commissioners to the fact that we were to have a large aquarium and stated that if any of the eastern states would like to, we should be very glad to show their fishes in the government aquarium, and that we would bear all the expenses of the shipment. Two weeks ago I addressed a letter to many of the State Commissioners, and I have here with me a plan of the exhibit and shall be very glad while here to explain fully any inquiries concerning it. We cannot placard each aquarium saying that these fish are from Massachusetts, etc., but we will publish a report showing where they are from, and we shall be very glad to do so. I would especially like to have the co-operation of the Eastern States, Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, New York and Pennsylvania.

The President: About what time will you want to receive the fish?

Mr. Ravenel: We would like to have them for the opening, but it is not necessary that they should be there early in the spring. It does not make a great deal of difference whether they get there on the opening day or not.

Mr. Dickerson: I desire to say that Mr. Ravenel will have the hearty co-operation of the Michigan Commission, and everything will be done that it is possible to do to make the exhibit everything that it should be.

The President: I will say for the Vermont Commission that we shall try and supply them with golden trout, lake trout, and brook trout.

Dr. James: We have several hatcheries in Pennsylvania, and I have not the least doubt but the Fish Commissioners will furnish anything that they can.

Mr. Root: I wish to say on behalf of the Rhode Island Commission that we are making very interesting experiments in the raising of the lobster, and we think we are going to make a success of it, and if we do we shall be pleased to make an exhibit of the lobster and also of oysters and clams. If we do succeed in propagating and raising them I think it will be something that has never been done before. I think there is no doubt but our experiments will be successful.

The reading and discussion of papers was then taken up in the following order: Papers of Mr. Clark, Dr. James, Mr. Babbitt and Dr. Henshall. President Titcomb then announced the programme for the next two days. Adjourned at 10 p. m.

*Thursday, July 19, 1900.*

On board the "Fish Hawk" for New Bedford.

Meeting called to order at 8:30.

The President: The first business in order will be the reading of the Treasurer's report.

**TREASURER'S REPORT.**

*To the American Fisheries Society:*

GENTLEMEN—I herewith submit my Annual Report as Treasurer from June 26th, 1899, to July 18th, 1900.

**RECEIPTS.**

June 26, 1899, to balance in treasury.....	\$294 56
1896 dues.....	12 00
1897 ".....	15 00
1898 ".....	5 00
1899 ".....	151 00
	<hr/> \$477 56

**DISBURSEMENTS.**

Acc't of 1898, by Secretary, directing envelopes ...	\$ 1 00
" 1898, " telegraphing.....	75
" 1898, by Treasurer, express.....	25
" 1899, J. S. Benner, services at meeting, Voucher No. 1.....	18 00
" 1899, G. H. Thurston, stenographer at meeting, Voucher No. 3.....	60 00
" 1899, Robert Smith Printing Co., printing proceedings, Voucher No. 4.....	91 92
" 1899, account Speaker Printing Co., print- ing and stationery (2), Voucher No. 5.....	9 50
" 1899, by Treasurer, T. Humphrey, printing and stationery (2), Voucher No. 6.....	7 50
" 1900, by Treasurer, typewriting and express	1 25
" 1900, " postage.....	11 28
" 1900, " collecting out of town checks.....	78
" 1900, express.....	25
July 18, 1900, by Secretary, Voucher No. 7.....	46 24
" 18, 1900, by Speaker P't'g Co., Voucher No. 8.....	12 50
	<hr/> \$261 22
July 18, 1900, balance on hand.....	216 34
	<hr/> \$477 56

L. D. HUNTINGTON, *Treasurer.*

We have examined vouchers and find the report of Treasurer as above correct.

GEO. F. PEABODY

L. B. HANDY

WALDO F. HUBBARD

Auditing Committee.

On motion of Mr. Clark the report of the Treasurer was accepted and adopted.

Mr. Clark: I wish to ask the Treasurer what the net increase in membership is.

Mr. Huntington: The net increase in membership over last year? About 24 or 25, I think about that, for the reason that we lost 25 members last year, and 18 of those were gentlemen that I assure you I have not sent less than four communications to, urging the payment of their dues, so that there are now none on the list liable to be marked off.

It has always been the custom to submit the report of the Treasurer to an auditing committee, and I would be very glad indeed to have my account audited by a committee.

The President: The chair will appoint as such committee Mr. Peabody, Mr. Handy, Mr. Hubbard. (See report above.)

The Committee on Time and Place reported as follows:

Mr. Root: I will make the report for the committee, stating that there were but two places named before the committee, Philadelphia and Milwaukee. The gentleman from Philadelphia after listening to the application from Milwaukee very graciously intimated that he thought Milwaukee had a prior claim, which left the duties of the committee nominal almost and they were unanimously in favor of recommending Milwaukee, and also that the time be about the same as this year, that is, we will have to start one day later on the calendar. Your committee unanimously recommend that this Society meet in Milwaukee, on the 19th, 20th and 21st of July.

On motion of Mr. Davis the report of the committee was accepted and adopted.

Mr. Peabody: Wisconsin thanks you for the honor, and I beg to say that the State Fish Commission joins with the citizens of Milwaukee in a cordial invitation to come to Wisconsin next summer.

We propose to take the members of the Society from Milwaukee to Wisconsin's new and magnificent hatchery at Bayfield, on Lake Superior, a night's ride, and more than two hundred miles from Milwaukee.

We have a hatchery there that we think in some respects is better than any other, and this because nature has provided great natural facilities, with an abundance of pure water.

We, from Wisconsin, who have come twelve hundred miles to this meeting, are hopeful that you Eastern people will accept our cordial invitation to come west next summer and prevail upon as many of your friends as possible to join you.

REPORT OF COMMITTEE ON NOMINATION OF OFFICERS.

Mr. Clark: Your committee respectfully submits the following report:

I wish to say, Mr. Chairman and gentlemen, that your committee in making its verbal report wishes to convey the thanks of this Society to every retiring officer, the officers of this Society for the past year; we wish to thank them for their good services.

After considering the names of the members of this Society your committee presents the following for officers for the ensuing year:

For President, Mr. F. B. Dickerson, of Michigan.

For Vic-President, Mr. E. E. Bryant, of Wisconsin.

For Secretary, Mr. Seymour Bower, of Michigan,

For Corresponding Secretary, Mr. W. de C. Ravenel, Washington, D. C.

For Treasurer, Mr. C. W. Willard, of Rhode Island.

Executive Committee:

Mr. Frank N. Clark, of Michigan.

Dr. B. W. James, of Pennsylvania.



Mr. Robert Hamilton, of New York.

Mr. J. J. Stranahan, of Georgia.

Mr. Alden Solmans, of Connecticut.

Mr. Buffington, of Massachusetts.

Mr. Nathaniel Wentworth, of New Hampshire.

Your committee recommends these as the officers for the coming year.

On motion of Mr. Morse, the report of the committee was accepted and adopted, and the officers for the ensuing year declared elected.

President Titcomb called attention to the fact that Mr. Buffington is not a member of the Society. On motion the name of Mr. Henry O'Malley, of Washington, was substituted for that of Mr. Buffington, and Mr. O'Malley was then elected a member of the Executive Committee.

Mr. Dickerson: Gentlemen, I thank you very much for the honor conferred upon me, by choosing me President, probably not so much upon me as upon the Michigan Fish Commission, and I assure you that every effort will be made to make the meeting at Milwaukee the red letter meeting in the history of this Society.

Mr. Clark: I would like to say that the President of this Society has something else to do besides preside at these meetings, and we expect the President to do something else besides post office business in the next year.

Mr. Bryant: In behalf of Wisconsin, I wish to thank you for the honor conferred upon that State by electing me as Vice-President, and I assure you that the office of Vice-President will not be regarded by me as a figure-head as it has been in the past. (Laughter.) My first step will be to issue a proclamation that you come to Wisconsin next year and we will assign you a brewery apiece in Milwaukee. (Laughter and applause.) We will show you that we are quite a wide-awake people.

The President: Before taking up the papers, we will re-

ceive applications for membership. We have some application cards here if anyone wants them.

Six names were then handed in and, on motion, the gentlemen were declared elected as members of the Society.

The President: Any further routine business or any unfinished business to be brought up at this time? If not, we will continue the reading of the papers. I have here a paper on the sturgeon, by Mr. Livingston Stone, who wrote me that he called it an apology for a paper. It is short and I think I will ask you kindly to give your attention.

The reading and discussion of the papers of Mr. Stone and Mr. Lamkin followed in order. Adjourned until after the trip to East Freetown.

On arrival of the Fish Hawk at New Bedford, a special car, provided through courtesy of Mr. Hurlbut, was found in waiting to convey the party to East Freetown and return. A very pleasant and instructive hour was passed at East Freetown, inspecting Mr. Hurlbut's brook trout hatchery and fine stock of trout.

AFTERNOON SESSION, JULY 19.

On board the Fish Hawk, returning from New Bedford to Woods Hole.

Called to order by the President at 3:45. United States Senator Proctor, of Vermont, accompanied the members on the return trip and was duly elected a member of the Society. Mr. Thompson's paper was read and discussed, and the officers and crew of the Fish Hawk gave an interesting exhibition of deep sea sounding and dredging, after which the session adjourned until 8 p. m.

EVENING SESSION, JULY 19.

No papers were read nor business transacted at the

evening session, but the members were entertained in a most pleasing and instructive way by President Titcomb, who gave an illustrated lecture on fish culture and kindred subjects. About 100 slides were shown and fully explained, reproducing in enlarged form photographic views of the ova, in successive stages of development, of trout, salmon, whitefish and wall-eyed pike; the fish from infancy to full adult size; methods of taking and incubating the ova; various forms of hatching apparatus and utensils; interior and exterior views of hatching stations; ponds and raceways and natural spawning beds; and wild-life and landscape scenes from mountain, brook and forest. As the illustrated talk proved to be a novel and highly interesting exposition of the subject in hand, it is to be hoped that other scenes and views may be added to Mr. Titcomb's collection, for exhibition at future meetings.

*Friday July 20, 1900.*

On board steamer Fish Hawk bound for the Narragansett Bay and Providence River.

The President: The meeting will please come to order. I will inquire if the auditing committee have audited the account of the Treasurer and are ready to report?

Mr. Peabody: Your committee have examined the report of the Treasurer and find it correct as read.

The President: I do not suppose it is necessary to act on that report.

On motion it was ordered that all papers not received before the final adjournment should be considered as read by title and that they be printed in the report of the meeting.

Then followed in order the reading and discussion of Mr. Downing's paper; address of Mr. Morse; discussion on the care and feeding of brook trout; suggested by the trip to the East Freetown trout hatchery; and the reading of the papers of Mr. Stranahan and Prof. Mead.

On call of President Titcomb, the Committee on Resolutions submitted the following report:

REPORT OF COMMITTEE ON RESOLUTIONS.

Dr. Bushrod W. James: The Committee on Resolutions respectfully submits the following for your consideration and adoption:

Whereas, The Society has received unusual courtesies from the United States Fish Commissioner in the freedom for use of the residence and biological rooms at Woods Hole, Mass., and placing at the disposal of our President for the use of our Society all the resources of the station, together with the unstinted use of the vessels, the Fish Hawk and the Grampus, which have afforded the members of the Society not only great pleasure but extraordinary facilities for the transaction of business. We desire to express our profound gratitude to the Hon. Geo.

M. Bowers for these favors which were made possible because of his broad and generous hospitality, feeling that the members of the Society present at this gathering will take away a lasting delight of this enjoyable meeting at Woods Hole in 1900.

2. Whereas, The success of this meeting of the American Fisheries Society has been largely due to the patient and untiring zeal of its valued President, we extend to him our heartiest appreciation of his energetic services and we extend to him a vote of thanks, and we likewise thank our most efficient Secretary and our careful Treasurer for their share in making this meeting a great success.

3. Resolved, That the thanks of the Society are also due Mr. Hurlburt, for the courtesies which have been extended to the members of the Society and their friends upon the visit to his Trout Hatchery, which was enjoyed by all.

4. Resolved, That the Society is not unmindful of the obligations due to the several officers of the United States Commission connected with this station for the many thoughtful courtesies received at their hands, and hereby make full acknowledgment of the same.

5. Resolved, That in the loss by death of our honorary member and most able and active worker in our Society, Mr. Fred Mather, as well as in the decease of Herschel Whitaker, another ardent, active member, as well as in the loss of Mr. E. P. Steers, and of Mr. A. Taylor, Jr., we feel deeply their removal from our earthly friendship and the severance of their relations that bound them to us in the active work in which our organization is engaged. And we request our Secretary to place a suitable minute in our transactions in memory of each and all of these deceased members.

BUSHROD W. JAMES,  
GEORGE F. PEABODY,  
H. W. DAVIS,

Committee on Resolutions.

On motion of Mr. Root, the report of the Committee on Resolutions was accepted and unanimously adopted.

Dr. James: In connection with this subject the thought occurred to me that it would be well for our deceased members to have a little more elaborate mention made of them, perhaps with a synopsis of their life-work and labors, and I think it will be well to have some one appointed to look after these matters during the year and sum them up. If agreeable, I would suggest that a necrologist be appointed to look after these matters. I trust none of the members will die, but I make the motion that some one be appointed as necrologist for the ensuing year.

Motion seconded and carried.

The President: I think no one is better fitted for that position than Dr. James, and I will appoint him.

On motion, Mr. Vinal N. Edwards was elected to membership in the Society.

The President: Is there any further unfinished business? Is there any new business to come before this meeting before we adjourn?

Dr. H. M. Smith: Mr. President, I desire to bring to the attention of the Society a matter which I believe will be favorably regarded by all the members, as well as by many other persons. It has seemed to me fitting that at this time and in this place provision should be made for a suitable memorial for one who most unselfishly and efficiently devoted his life to the cause of fish culture, the fisheries, and marine biology, and who more than anyone else was responsible for the magnificent establishment and work of the government at Woods Hole. Of course, no nobler or more appropriate monument could be erected to the memory of Prof. Baird than the one which already exists here; but it seems to me that simply as a matter of respect some memorial should here be set up to attest that American fish culturists and biologists are not unmindful of his distinguished services, and to show to the general public, more especially the coming generations, the connection of Prof. Baird with the fish cultural and scientific work here carried on.

It is to be regretted that at the capital city of the country, where for many years Prof. Baird was a leader in biological and general scientific research, as well as one of the best known and most highly respected citizens, no monument of any kind has been erected to the memory of this great and good man, who, to my mind, was just as much entitled to such an evidence of the nation's respect and gratitude as were the distinguished naval, military and political persons with the statues of whom Washington's parks and squares are filled.

Will it not be especially appropriate for this Society, which

so ably co-operated with Prof. Baird in securing the establishment by Congress of the National Fish Commission, to take the initiative in thus honoring his memory at a place which he conceived and developed, where he spent some of his happiest days and directed some of the most important work of the Commission, and where thirteen years ago he breathed his last?

For the purpose of bringing this matter formally before the Society, I have drawn up a set of resolutions, which I will now read.

Whereas, The American Fisheries Society, assembled at Woods Hole, Mass., regards as desirable and proper the erection of a tablet or monument to the memory of the late Professor Spencer F. Baird, in recognition of his distinguished labors in behalf of fish-culture, the fisheries, and biological science; and

Whereas, The Society deems it appropriate that this memorial should be located at Woods Hole, as a special tribute to his zeal in furthering the interests of marine biology and fish-culture; therefore,

Resolved, That a committee with full powers be appointed by the Chair to determine the most suitable form of the memorial, to raise the necessary funds, and to proceed with the erection of the monument; provided, that no financial liabilities be incurred on account of this Society without express permission.

Resolved, That the committee notify the surviving members of Professor Baird's family of the proposed action, and invite suggestions thereon.

Resolved, That a copy of these resolutions be transmitted to the United States Commissioner of Fish and Fisheries.

Mr. Clark: With the permission of the members of this Society may I have the privilege of moving that these resolutions be adopted. I know for one thing that I am one of the oldest men in point of service that commenced under Prof. Baird, and I am very much touched. I move the adoption of the resolutions.

Motion carried unanimously.

The President: I will take a little time to consider the names to be appointed and announce them later. Is there any further new business or unfinished business to be brought up at this time. The meeting will not adjourn now as we are liable to have business come up at any time. I am sure there will be one matter coming up at the clam bake; we will therefore simply suspend

our business for the present and take a recess until after the clam-bake.

AFTERNOON SESSION, JULY 20.

Convened at 3:45 p. m., Field's Point, R. I.

The President: Gentlemen, will you give your attention for a minute or two. I understand the Committee on Resolutions have a resolution to offer.

Dr. James, Chairman: I have a resolution to offer on behalf of the Committee.

Resolved. That the thanks of the Society are extended to Mr. Root and Mr. Willard and to the Rhode Island Fish Commission for their delightful and refreshing entertainment at Providence and the invitation to a Rhode Island clam-bake, thus giving a most enjoyable and novel treat to the members of the Society.

Mr. Dickerson: I want to make an amendment to the motion of Dr. James. I know that every member of the American Fisheries Society appreciates the courteous treatment they have had at the hands of everybody, and I want to speak especially for the western members, who heartily appreciate the courteous treatment received at the hands of the Commissioners, both of the United States and from the State of Rhode Island. I was just saying to my little girl that I have never had as enjoyable a time in my life as in the last four days. I want also to include the superintendent and the employees of the Commission. It seems to me that even the dock hands have gone out of their way to pay tribute to the members of this Society, and I think they and everybody connected with the Commission deserve our thanks and I therefore amend the motion of Dr. James, and move you, sir, that we extend a rising vote of thanks to the United States Commissioner and to the Commissioners of Rhode Island, and to the employees of the Commissions, for the consideration and courteous treatment we have received. (Applause.)

Dr. James: I want to accept the amendment of our new President.

Gen. Bryant, of Wisconsin: Mr. President, I beg to say one word in support of the resolution. This day has been one of very



pleasant experiences to all of us. It has added to my days one to be remembered as one of the grand feast days of my life. During the course of a not uneventful life I have been in many regions and tasted the viands so dear to the people there dwelling. I have eaten pumpkin pie in Vermont, johnny cake in New Hampshire, the baked beans and codfish balls of Massachusetts, tripe and sour kraut in the Mohawk valley, the capons of Pennsylvania, Smithfield hams in Virginia, terrapin in Maryland, corn pone and bacon in Georgia, and "possum" in Tennessee; I have fared on the best that grows in the fertile states of the west; partaken with relish of the scant fare of the soldier, the "hard tack and sowbelly," and the "Rappahannock stew," made by boiling bacon rinds with leeks and ham bones. I have eaten *boskamin-asagon paguegian* made by the squaws of the Chippewas, and tasted the "*pe-we-ta-gah*," the crowning dish of a Winnebago feast, made by stewing pulverized dried venison in bear's oil and maple sugar. I have fooled away a good part of a month's pay in a swell dinner at Delmonico's, and thought I had tasted of about all the good victuals of this our bountiful union. But to-day, as the grand cap-sheaf of all, I have feasted to fullness at a clam-bake on Narragansett Bay. I had read of these in my boyhood as I had read of the ambrosia of mythology, and they left in my mind the dim impression of a half-formed dream. I had heard that Rhode Island clams, baked on the shore and with the drapery of the sea weed to cover them, were good, but I can now say with the Queen of Sheba, that the half had not been told me.

I know now, since we sailed up this beautiful bay, and since partaking of this feast, why we seldom see a Rhode Islander in the west. We have Maine Yankees, New Hampshire Yankees, Vermont Yankees, Massachusetts Yankees, Connecticut Yankees and Yankees in general thickly sprinkled through the west, and splendid state-builders they are; but we hardly ever see a Rhode Islander. I knew one of them once, and a good man he was, who lived a few years in a western city; but his heart so yearned for the sea shore and the clam-bake that he quit a good

business and returned to his native state. Later, he sent us a barrel of clams, but we couldn't find a longshoreman to show us how to cook them, and we failed to find the richness of the gift. No wonder the Rhode Islander clings to his native shores and his feasts upon the beach.

It was Tom Moore, I believe, who sang:

"Take the bright shell from its home by the lea  
And wherever 'tis borne it will sing of the sea.  
So take the fond heart from its home and its hearth,  
'Twill sing of the loved to the ends of the earth."

And he might have added:

Take the Rhode Islander from his home by the Bay,  
And wherever he goes you can't make him stay.

Let us congratulate our friends, the Rhode Island Commission, and her good citizens who have given us this occasion and graven on our memories a red letter day's pleasure, for their lovely homes and their happy lot; and let us thank them, in a heartier way than by mere formal resolution for their large-hearted hospitality, their kindly welcome and their daintiest of banquets—the clam-bake on Narragansett Bay. (Applause.)

The President: All in favor of this motion will please express it by a rising vote. The vote is unanimous.

Mr. Root: On behalf of the Rhode Island Commission I wish to say that we deem it an exceedingly great honor that the American Fisheries Society accepted our invitation here, and if you feel satisfied we shall feel exceedingly gratified. I can supplement all the remarks the gentlemen have made. I certainly enjoyed it all from the very first moment to the last. It was a business meeting and we have got our heads filled with new ideas, and practical ideas, and everybody will go away feeling and knowing that they have met a body of gentlemen that know their business. I thank you heartily, gentlemen, on behalf of our Commission for accepting our invitation. (Applause.)

The President: There was a little unfinished business. A committee was to be appointed to prepare for a monument

to the late Spencer F. Baird, of Woods Hole, Mass. The Chair will appoint as that committee the following:

COMMITTEE ON MONUMENT TO PROFESSOR SPENCER F. BAIRD.

Dr. H. M. Smith, Chairman.

Hon. Eugene G. Blackford.

Dr. E. W. Blatchford.

Hon. George M. Bowers.

Mr. Frank N. Clark.

Mr. Vinal N. Edwards.

Hon. George F. Peabody.

Hon. Redford Proctor.

Mr. W. de C. Ravenel.

Dr. Bushrod W. James.

And the Chair will take the liberty to authorize this committee to increase the list if deemed essential.

I will also suggest in connection with the membership list that a motion would be in order to authorize the President and Secretary of this Society for the ensuing year to add to the list of members elected at this meeting any applicants whom they deem eligible to join the Society, and who may present their names and pay their dues before the transactions of the Society are printed. Will you entertain this as a motion?

Mr. Dickerson: Is it your idea that your forthcoming President and Secretary shall decide whether such parties are eligible or not?

The President: Yes, sir.

Mr. Dickerson: And that any name approved by the President or Secretary before the proceedings are completed, will entitle them to membership?

The President: As of this year.

Mr. Dickerson: I desire to have the Society thoroughly understand the motion.

The President: I will say that last year the President and Secretary undertook to do that same thing. It seems to me if the meeting here authorize your President and Secretary this

year to do the same thing there will be a number of members come in and pay their dues at this time.

Mr. Davis: I think we ought to consider that motion very carefully before we act upon it. Owing to the offer of General Bryant we expect that a small army will go to Milwaukee; as we have the offer of a brewery apiece over there I think the whole population of Grand Rapids will turn out and go to Milwaukee. (Laughter.)

The President: The Chair takes it to be the motion as seconded that the incoming President and Secretary are authorized to add to the list of members, such names as are presented, with their dues, before the transactions are printed, and will print their names as members of this Society for this year.

Motion carried.

Dr. Bumpus handed in the names of six candidates for membership and, on motion, the gentlemen were declared elected.

The President: Is there any further business before this Society?

Dr. James: I move that we adjourn sine die.

Motion seconded and carried.

Adjourned at 4 p. m. at Fields Point, R. I., July 20, 1900.

Deceased Members Since Last Annual Meeting.



Fred Mather

Herschel Whitaker

A. Taylor, Jr.

E. P. Steers

S. W. Milbank



PART II

PAPERS AND DISCUSSIONS





**EXHIBITION OF "ORIGINAL CONTRIVANCES" FOR USE AT BROOK  
TROUT HATCHERIES; WITH DESCRIPTION AND DISCUSSION.**

By C. C. WOOD, Plymouth, Mass.

Gentlemen: I have not prepared any paper at all on this subject; I just wish to show you some "Original Contrivances." If anyone has anything better I should be very glad to know it now.

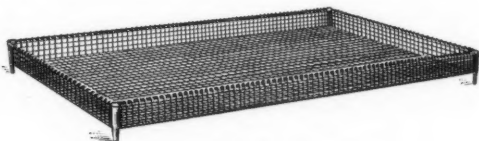


FIG. 1

This is a hatching tray (Fig. 1), that we use over in Plymouth, made entirely of wire. It is raised up from the bottom of the hatching trough by a little wire leg at each corner, so. When it is placed in the trough there is a circulation of water underneath, as well as over, and being all wire it gives more room for the eggs, and then there is no wooden edge to collect slime or fungus.

Mr. Clark: As he goes along are we going to ask questions? If so, I would like to ask a question on the tray now. Do we understand that you use that tray for hatching the eggs?

Mr. Wood: Yes, sir.

Mr. Clark: I would like also to ask Mr. Wood how many trout he handles?

Mr. Wood: About 700,000. We put on that tray, say 10,000 eggs, and the eggs are left there until hatched.

Mr. Davis: Do you think it would improve it to have an oblong mesh?

Mr. Wood: Not at all.

The President: Mr. Wood, do I understand that the fry drop through this wire tray just as they do through the oblong?

Mr. Wood: Yes, without trouble.

The President: Is this galvanized iron cloth?

Mr. Wood: Galvanized and painted two coats.

The President: Do you find the galvanized iron cloth is cheaper in the end?

Mr. Wood: Yes, more durable. If anyone is thinking of getting trays like this I would suggest they have the wire cloth made flat, as if taken from a roll it is difficult to make the trays perfectly flat on the bottom.

The President: What is the comparative cost of this tray over the wooden tray?

Mr. Wood: As we find it, it is cheaper, but galvanized iron unless painted will kill the eggs.

Mr. Ravenel: Why do you say that galvanized iron will kill the eggs; have you ever tried it?

Mr. Wood: Yes, sir; we find that the galvanized iron where the egg is laid on the tray will kill the egg.

Mr. Ravenel: Fish are carried in galvanized iron tanks with safety.

Mr. Clark: I would say that we have probably 400 trays made of galvanized zinc, and there is not a particle of paint on them, and the trout eggs are handled on those the same as those having paint. They have been used for four seasons and we have them in use now.

Mr. Wood: Do you use them for green eggs?

Mr. Clark: Green eggs, and until the sacs are gone, when they are taken from the trays and distributed.

The President: Mr. Clark, I would inquire if you use this kind of mesh?

Mr. Clark: No, sir, the size of the mesh is always governed by the size of the fish. Our experience and our plan at the Northville Station is always to hold the fish on the tray until the sac is gone.

The President: That is in the Clark Hatching Box?

Mr. Clark: Yes, and the Clark-Williamson, too. We do not remove them from the tray they are on; they are left until after the sac is gone, until distribution.

The President: I would like to inquire of Mr. Wood if he sees any advantage in this over the oblong mesh?

Mr. Wood: I have not used the oblong. This seems to answer the purpose very well indeed.

The President: You stack those trays one upon another?

Mr. Wood: Oh, no. I find I can hatch as many trout eggs on that tray as it will do to keep on a hatching tray.

Mr. Clark: We hatch 40,000 fry and it doesn't take as much space as you have there. In one box we hold the whole 40,000 fry until they are ready to distribute.

Mr. Wood: At what age are they distributed?

Mr. Clark: When the sac is gone. If we did not hold them in some such compact way as that, I don't know how we could handle from 5 to 10 and 15 million trout eggs in an ordinary hatchery.

Mr. Wood: I would like to say in all the Eastern hatcheries the plan has been to use the single tray system. I have never seen any other, and we, in our hatchery, seldom sell any fry before they have been feeding at least six weeks. We hatch out 100,000 fry in a space 20 feet long and one foot wide, and they run pretty thick. We always feed our fish before putting them out; in fact, people won't buy them unless we do so.

The President: Your fish hatch in mid-winter?

Mr. Wood: Usually about the first of January.

The President: Is there any further discussion about the tray?

Mr. Ravenel: It is the same kind that Mr. Buck made; practically the same tray. I had a sample sent to my office, but it was all iron.

Mr. Wood: How long ago?

Mr. Ravenel: About a year ago.

Mr. Wood: We have used this kind of tray five years.

As we feed all our fry, we found it considerable trouble to take care of several hundred thousand trout fry when we feed them. After fooling around a good deal I got up something of

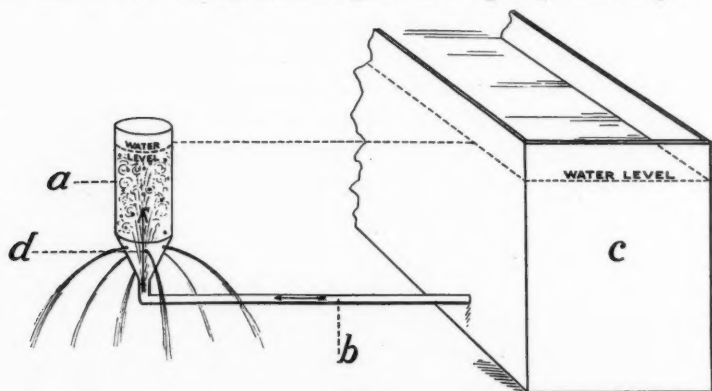


FIG. 2

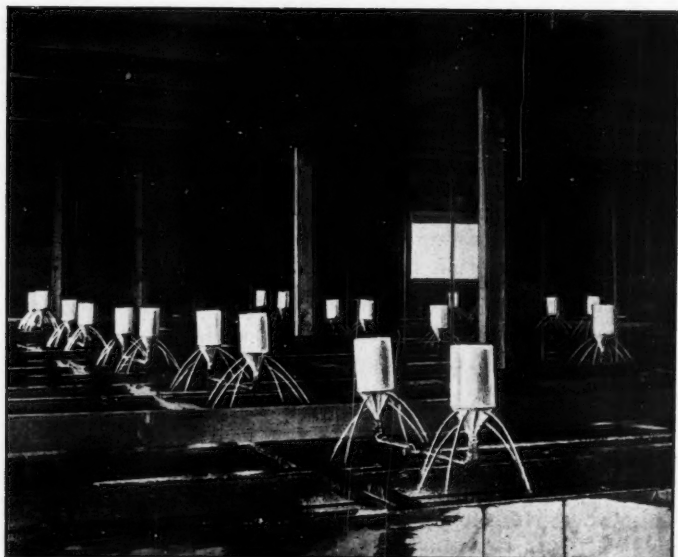


FIG. 3

this kind (Figs. 2 and 3). During the first month of feeding we find it a great help. Around this feeder are six holes—three on this side and three on this side here. We connect it with the supply pipe in this manner; that screws right under there. We set that between the two boxes. It sets like that. I will take this piece of paper to illustrate the box. This pipe here is connected with the supply reservoir; we regulate the supply of water which comes in here up through the center until the cup is almost full. The current keeps the water agitated and also the food, and it is some little time before the particles of food find those little holes and go out, and when they do, they go with a nice little current, and the trout fry will go for them eagerly. We put three of these double feeders on a box, and in feeding them we go along with a quantity of food, taking it up with a syringe and putting a little in each box. The little fry cluster around by the thousands at feeding time and hustle for the food. It is simple, and I have never seen anything like it before. We like it very much and have used it for five years.

The President: I would inquire of Mr. Wood if he would use that for aerating purposes only?

Mr. Wood: I would if the water supply was small. It depends on what water supply you have. We raise a good many fry, considering the space and on a little water.

Mr. Ravenel: What is your water supply?

Mr. Wood: The total water supply? I can't tell you exactly; somewhere about 300 gallons a minute.

The President: For the hatching house?

Mr. Wood: No; for the whole plant.

Mr. Clark: How many fish have you on hand?

Mr. Wood: At the present time we have sold something over two tons of market fish. We have on hand about 10,000 year old, 7,000 two years old and 250,000 fry. We have a hatching house in which we can handle three million eggs at the Nook hatchery, which we take about every season.

Mr. Thompson: I would like to ask if he gets his total water supply through there?

Mr. Wood: We have a faucet over the trough that supplies us with the hatching water, as we don't use these at all during the hatching.

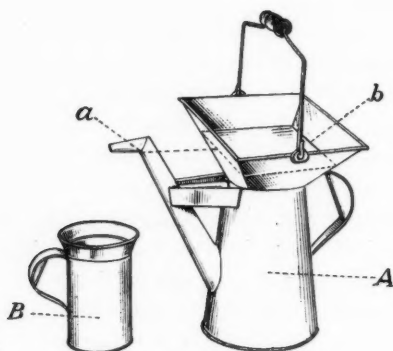


FIG. 4

Now, in selling trout fry, we have customers who are often very particular to get the exact number (it does not matter whether they are selling at \$1.50 or \$3), and I always like to have a customer that way. I wish every customer would count his purchase. It bothered me a great deal to count the fry, and I rigged up something of this kind (Fig. 4), which is much better than a dry measure and a tin dipper, and we use it in this manner: I set it on the bench and fill it with water, and I put the measure under here, and I count out a thousand fry or two thousand; perhaps five thousand—of course putting those in a pool by themselves; then take those out with a net and put them in here and measure the water which they displace. Now, it does not matter whether I take one-half or just a few at a time; if I find 5,000 in there displaces one-half pint of water, why, I think it is pretty fair to judge that half a pint of water displaced is a fair estimate for 5,000 fry.

The President: Any inquiries about the measure?

Mr. Ravenel: I will say, for Mr. Wood's information, that at a great many hatcheries, where they have to count fry, they do it by weight. They count out a thousand and put the fish in the scales and weigh them, and then simply go on repeating in that way, adding so much water and so many fish.

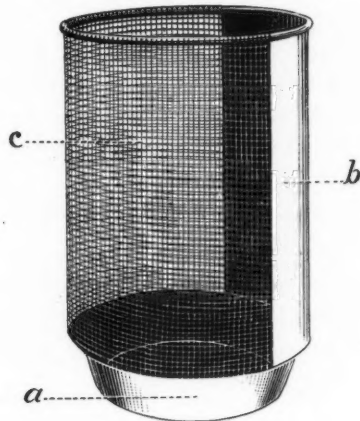


FIG. 5

Mr. Wood: When we make a shipment of trout, sending out 20 or 30 cans, we often have to turn out very early in the morning, and I thought of something so we could get the trout ready the day before. This does not look like much of a rigging (Fig. 5), but I had to think over it for quite a while for all that. It is better than a square box for this reason: We put this in a pool and count the fish in here, whatever number we want, 100 or 1,000. In the morning we have our cans ready, our express team comes and we pull these out of the water and empty out the fish. This pan holds some water, enough to lubricate the fish, so to speak. The tin here keeps them from getting scraped on the wire cloth. We take them out and pour the fish into the can, and sufficient water goes with them to prevent injury.

Mr. Clark: I suppose that is for shipping just one or two cans?

Mr. Wood: Oh, no; forty or 50 cans; or one hundred, if necessary.

Mr. Clark: And you would use those for forty or fifty or one hundred?

Mr. Wood: Certainly.

Mr. Clark: And the object is to save time in the morning?

Mr. Wood: Yes, sir.

Mr. Clark: Mr. President, I want to state here that we loaded from our fish hatchery, since the 1st of July, 100 cans in 45 minutes, taking the fingerlings from the tank where they were held, and they were weighed up accurately; cans filled with water and fish put in them in 45 minutes.

Mr. Wood: How much help do you have?

Mr. Clark: Six men.

Mr. Wood: We have no men; I can do it myself. I would like to ask Mr. Clark how many yearlings he puts in a can?

Mr. Clark: Do you mean fish that are actually a year old?

Mr. Wood: Oh, no.

Mr. Clark: We don't distribute many fish after a year old.

Mr. Wood: Then, perhaps, you mean fingerlings. What was the number of cans?

Mr. Clark: One hundred cans in 45 minutes.

Mr. Wood: What month?

Mr. Clark: This was a few weeks ago.

Mr. Wood: How many would you put in a can?

Mr. Clark: Well, I can't tell you whether 650 or 700. Of course every time a car comes in we have to count and weigh again in order to get our standard.

Mr. Wood: What size fish?

Mr. Clark: Well, two and a half to three inches.

Mr. Wood: Our fry will average about two inches long. I usually put about 1,500 in a can, and we have found this a great help in saving time, because we have to count them in the morning unless we use this.



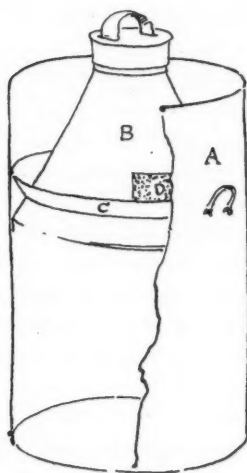


FIG. 6

The cans which we use for shipping purposes are something like this can here (Fig. 6); an ordinary ash barrel, and we fit into that a solid conical top here, about the center of the can. A little way up we put in a tin strip. That is done because occasionally in dipping them a trout will get out on the side, and it is easier to remove them from the tin strip than if it were not there. Around the circumference here are pieces of perforated tin. We fill the can with water and pack ice around the top of it. The ice, as it melts, trickles through the perforated tin, which answers every purpose of a refrigerator can, with the additional convenience that we can get at our fish without trouble. I have been with twenty of those cans on a long journey, taking 1,500 fish to a can, and would like to have an opportunity of going on a long journey with another load, if I can get an order after this meeting.

The President: I would ask first if there are any inquiries about his arrangement for keeping the fish over night? Any questions about the can?

Mr. Nevin: I think the can is very nicely arranged for shipping fish a short distance.

The President: What do you use, Mr. Nevin?

Mr. Nevin: An ordinary milk can.

Mr. Wood: I would say that the express companies usually charge us for about everything they can, and additional ice is sometimes charged for.

Mr. Bennett: I would like to ask how he disposes of the water after it gets stale?

Mr. Wood: Take it out with a dipper.

Mr. Bennett: Over in here we put a cap with a perforated wire on, and after this gets full here we unscrew this cap and the water will run out.

Mr. Wood: I think that any outside arrangement like that the express companies will surely knock off in handling, and that is why there is no cover to this can for they get lost; and now when they take a wagon load of trout over the pavements without covers, the express fellows are pretty sure to get wet, and it serves them right, too, I think.

The President: What price do you give for your cans, Mr. Bennett?

Mr. Bennett: I pay \$4.50 each, and I get the cans of the Iron Clad Manufacturing Co., of New York.

Mr. Wood: Quite often we take a dipper full of water and throw it out of the car as we go along, and I would never go on a trip without a dipper.

Mr. Handy: I would like to ask Mr. Wood if that is white paint?

Mr. Wood: I am glad you asked that. I have always wanted my cans painted white and I never dared paint them with white lead. I wrote to the superintendent of the hatchery at Cold Springs Harbor, L. I., a short time ago, and asked him what he used, and he told me they were in the habit of painting their cans with white paint, but before he answered my letter I had already got some paint, and this is the can I painted. You mix the paint up with water and a little oil. I sent a load of fish

up into Vermont a while ago that went from Boston, and were gone six hours without any attendant, and the man reported they arrived in good shape, so I went to work and painted all my cans with it. I get the paint of Nash, Winslow & Co., of Boston; they are well known dealers. It is what is called "aquol" paint.

The President: What does it cost?

Mr. Wood: It costs 10 cents a pound in 10-pound lots.

The Secretary: I would like to ask Mr. Wood whether he has ever steamed his cans since he used that paint? It is a question whether they would stand steaming or not. We find it necessary to steam our cans occasionally to keep them clean and free from "fishy" odors, particularly in warm weather.

Mr. Wood: I never tried it. We always wash our cans though, thoroughly.

The President: Any further inquiries about the can?

Mr. Bryant: When you deliver a considerable quantity, you get them through safe?

Mr. Wood: We guarantee delivery with attendant; still we sometimes send them from Boston to St. Johnsbury safely alone.

The President: About five hours?

Mr. Wood: Yes, I should judge so. You are a better judge than I. We can send them from Boston to New York City; the swash of the water while on the train helping to keep them alive. I know there are refrigerator cans which some think are just as good as these, yet in carrying trout I never like to make the water any colder than necessary. I wouldn't take the fry from our hatchery, where the water is 52, and cool it down to 35 and expect them to live under ordinary conditions afterward. I remember at one time I took a lot of trout, and there was a difference in the temperature of 8 degrees only; the water we had put them in was 8 degrees warmer. I was in a hurry and dumped the trout out, and the man wrote me that he picked up several hundred dead trout the next day.

The President: I think Mr. Hurlbut ought to tell us a little about his can.

Mr. Hurlburt: I wish to say here that we ship everything

from Freetown right through to Vermont, starting about 4:30 in the morning. We load them up and get them over to the depot between 4 and 5, most of our shipments, and we have had no trouble so far. We send them by express without any messenger. I should disagree with Mr. Wood regarding temperature. Of course we have our different experiences. I don't think you can have water too cool for trout, providing you cool the water slowly and keep it cool until you get to your destination; then remove the ice box from the can, and dip water from stream to raise temperature of water gradually, letting them stand five to ten minutes, and turn them into the stream, and you have no trouble and no losses in shipment.

The President: What can do you use, Mr. Hurlburt?

Mr. Hurlburt: I use the S. E. Land refrigerator can; nothing else.

The President: I will say in reference to the temperature of

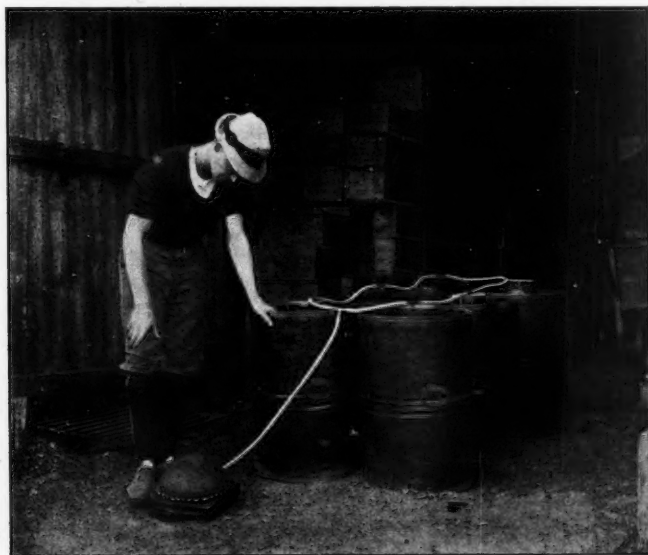


FIG. 7

water, it has been my experience that you cannot get the water too cold for an all-day shipment, but you can kill your trout by giving them a sudden change. You can kill all of your trout very quickly, and I think if we who raise trout could plant them, or have our experts plant them instead of having Tom, Dick and Harry receive them at the train and dump them, that in many instances we would get much better results. Is there anything further about the can?

Mr. Wood: Now, this next rigging is the last (Fig. 7). In carrying a lot of trout and a lot of cans, as I said before, I would have a dipper, but I find this arrangement is a great help, and you can see how it works. We put that tube with one hole through the end into the can. If the hole is too large, it doesn't work nicely, because all the air can get out of one or two tubes; when if the hole is small it will act in this manner, in the manner of a blow pipe. We put this tube in here, which will go, perhaps, six inches under the water. If allowed to go too far down, sometimes the fish will be thrown against it and injured. We put another one of these tubes on this side of the pipe and put another can here, and we can connect about a dozen cans in this manner to one blower; and then, after we have once arranged the cans, all we have to do is to keep our foot going, and you can keep trout alive with this arrangement, the can perfectly still, for eighteen hours without changing the water, as I have done with 200 fish four inches long in one of these cans. Of course we had to do considerable pumping along the last few hours.

Mr. Ravenel: That was a hatching house experiment?

Mr. Wood: Yes, sir. It is a great help when you have lots of fish to carry. This blower works better than a bellows, because the rubber reservoir gives a constant stream of air. With a pump it don't seem to work very well. I have worked these cans in express cars when everything has been crowded up—when we couldn't get between the cans; but had to climb over the first cans to look at No. 12 up in the corner. I think that is all, gentlemen, I have to say. I am sorry you are not coming to

Plymouth, but you will see, perhaps, some of these arrangements at Mr. Hurlburt's.

Mr. Davis: I would like to ask Mr. Wood if it isn't a fact that ice will take largely the place of air in your cans?

Mr. Wood: It would by lowering the temperature of the water.

Mr. Davis: Wouldn't it be better for the trout, rather than to let the temperature rise, to use ice and not your pump?

Mr. Wood: I don't think so.

Mr. Davis: I understand you don't use the blower if you use ice?

Mr. Wood: Yes, we do. I never get the temperature of the water any lower than I think is absolutely necessary, and that is perhaps about 47 or 48.

Mr. Davis: Don't carry them any lower?

Mr. Wood: No, sir.

Mr. Davis: I have great faith in ice. Some two years ago we went out bass fishing on the Kalamazoo river. At the little place near where we caught our fish we couldn't get any ice. We loaded the fish into barrels and did what we could on the way. Before we arrived at Kalamazoo, where the ice was, every black bass was at the top of the barrel on his back, and we had men with pails and dippers changing the water. We had telegraphed ahead for ice, and the moment we began using it the fish began to recover. We put in a piece as big as a pail. The fish had been carried in water of probably 75 degrees. We kept a big chunk of ice in the barrels until we reached Grand Rapids, and the fish all revived soon after we put the ice in.

Mr. Wood: That was bass. I am speaking only about trout. I never carried any other fish, but I should think, everything considered, that it was best in most cases to keep the water about the same temperature that the fish have been living in, and I do it to prevent the sudden changes which, if we arrive at night, might be almost impossible to prevent when putting the fish out; but if everything else failed, I would not hesitate to put ice in, even if we got the temperature very low.

Mr. O'Malley: I would like to ask Mr. Wood—you spoke of keeping fish alive eighteen hours—did you use ice at the same time?

Mr. Wood: Yes, to keep the water at an even temperature.

The President: About what temperature?

Mr. Wood: About 47 or 48.

The President: If you had that can aboard a baggage car and people smoking cigars, etc., around there, and pumping that air into those fish, do you think it would be as good for them as to keep the water at a much lower temperature with ice?

Mr. Wood: I have never seen any ill effects, and then I always think the air at the bottom of the cars is better than at the height we are breathing; better than anyone would think unless they got down and tried it.

The President: Are there any further questions? Have you any cuts of any of these?

Mr. Wood: I have a cut of the can and little feeder. I have no cuts of the other apparatus, but intend to have them.

The President: So that we could use them in illustrating.

Mr. Wood: I would be pleased to supply them to you.

The President: I want to say a word about transportation. We have different methods in Vermont. We have the old-fashioned can, that is about as large as this, and then comes up narrower and opens up in the top, with a strainer in it. It takes up a good deal of room and is clumsy. Then we have the ordinary 10-gallon round-shouldered can for shipments of from 3 to 10 hours. We get along very nicely with that if we send a messenger. After we have cooled the water in the can we invert the cover and fill the cover with ice, and we find that with the ordinary swashing on the baggage cars that the little piece of ice in the cover on top is about all that is necessary, and we don't work over the fish at all unless they stand at the station fifteen or twenty minutes. We keep our temperature right down, anywhere from 34 to 36 degrees.

Mr. Wood: Your shipments do not require fish to be kept so very long in the can.

The President: Not over eight or ten hours; an average shipment is about six hours. Then we have shipped in the Land patent can. All railroads transfer our messengers and our fish free, but in making our shipments it takes more help than the State will warrant. We use the Land patent cans, put them on board in charge of the baggage master, and sometimes they change cars at three or four junctions to get around the State. We do not hesitate to ship in that patent can in baggage cars for trips of six to ten hours without any messenger whatever, and we have never lost a fish.

Mr. Ravenel: We have sent rainbow trout through the south in the fall, temperature about 52, with practically no loss.

The President: You don't put the temperature down as low on rainbow trout as speckled trout?

Mr. Ravenel: No.

The President: We sent out this spring shipments of trout for the United States Fish Commission that started at midnight and were on the road all the next day until the next afternoon about 4 o'clock. My messenger took care of them all that time without loss during the trip.

Mr. Clark: It seems to me that great stress is laid upon the use of ice around the can, but nothing has been said about putting the ice in the can where the fish are. I don't have much practical experience in carrying fish now, but I used to. I have used ice in the cans with the fish for twenty-five years, and there is no objection to it. If your fish are in good condition and well taken care of, and all right, they will get down below the ice and stay there, so that your ice may just as well go in the water. The can that Mr. Wood has is something similar to what has been tried before, and is a good thing, but there is certainly no objection to having your ice in the water. You all lay great stress in having your ice melting and the water dripping in and not coming in contact with the fish.

Mr. Wood: We never hesitate to put a piece of ice in the can when necessary, but in starting if we put all the ice in the



can it will only lower the temperature for the time being. If you wish to put a piece of ice in, take a piece up occasionally and put it in, then if we get an additional supply at a station, it is put in around the top and we get the benefit of the ice as it melts, because all that melts helps keep the water cool. Besides it is very handy, and although one piece of ice may not injure the fish, yet by putting in a whole lot of ice at first and putting them on a truck and carrying them to the depot, some of the fish are liable to get hurt, if in the best possible condition.

In regard to the transportation of trout, it is of course to our interest to carry as many as we can, even if the customer pays for transportation, for it costs him enough in any event. I have recently been with trout fry for twenty-four hours, giving them constant attention, and I would say that the labor required depends much on the number of fish you have in a can. While on some of my trips I frequently meet many of the Government or State officials, and I must say that these gentlemen always care for their fish with about one-quarter the attention that I find mine require.

Mr. Clark: I am afraid people will infer from what has been said that we pitch a half a ton of ice into a single can. We simply give a can of fish the necessary amount of ice to keep the temperature down to the desired point; the rest of the ice is taken care of in extra cans, but we do not fill the cans containing fish solid with ice; simply use what is necessary.

The President: You will excuse the Chair for saying any more on this subject, but my line is trout work. The same idea that he obtained is what I brought up about this round shoulder can, about using the inverted cover. If you have to save ice there is a drip from that cover into the water, and I have an idea it will act as an aerator. Of course, we carry other fish than brook trout, but if you take the rainbow trout you can't have them so cold, and if you take the steelhead trout, you can't have them so cold. A lake trout will stand just about as much ice as a brook trout, won't they? I like the idea of using some can with a cover

that way; I think you will find it a very nice way of handling your fish.

Mr. Wood: Excuse me, do you get the same advantage as this with no cover full of ice to lift, when you wish to look into the can?

The President: Oh, yes. Your cover is right up where you can easily glance in.

Mr. Bryant: What does that can cost, of the same capacity as a milk can?

Mr. Wood: I can't tell you. These are made from the ordinary ash barrel, and they cost us \$4 apiece.

The President: What is the shipping weight of that can, loaded with fish?

Mr. Wood: 150 pounds.

The President: Anything further on the can,—on Mr. Wood's talk? If not, we will now have Mr. Brewster's paper.

## THE RELATION OF THE FISH AND GAME WARDEN IN THE WORK OF FISH PROPAGATION.

---

BY C. E. BREWSTER, GRAND RAPIDS, MICH.

The rapid depletion of our waters of its food fishes by reason of the vast increase both in the number of men engaged in fishing and the number of nets used, has made it necessary for the enactment of laws for the artificial propagation of the desirable kinds of fishes to re-stock our lakes and streams.

This work has usually been placed in the hands of State Boards of Fish Commissioners. Their duties are the taking of spawn, the hatching of the eggs, the apportioning of the fry to the various waters, and superintending the depositing of same.

In my own State of Michigan, with her more than two thousand miles of coast line bordering the "Great Unsalted Seas," with her thousands of inland lakes and streams all teeming with fish, the question of either protection or perpetuation did not present itself to the earlier citizen. Whitefish and trout were abundant in the Great Lakes, and every settlement near enough to the coast to do so had a few nets, usually owned in common, and used for the purpose of taking fish for their own use only.

In the coast towns a few men had nets and made fishing their business. The nets were of large mesh, and the fish taken were necessarily so. Sail boats only were used, and three men could handle two gangs of gill-nets, possibly three miles long,—one gang only being in the water at a time.

But with the rapid increase in population, conditions changed. Factories and manufacturing plants were built to utilize the product of our forests. Sawdust and slabs were dumped into the waters without protest. This offal, as it became saturated, sank and shifted around on the bottom, driving out the whitefish. Fishermen cleaned their fish on board their boats, dumping their offal into the lake.

And then came the tug fishermen. And with the advent of the tugs came a marked increase in the number of nets used. Methods of handling nets and fish have been improved. Steam lifting apparatus has taken the place of men, and it is now possible to lift nets on a single tug at the rate of four miles an hour, and it is not an unusual thing for fishermen to set a single gang of nets fifteen miles in length.

John O'Neil, a prominent commercial fisherman at Charlevoix, informed me that upon the 29th day of last October (the last day of the open season) he had seventy-five miles of gill-nets in the water.

But to return to the sawdust and offal matter: It became apparent in the course of time that the fish supply in the Great Lakes was decreasing, and in 1865 the Legislature passed an act making it unlawful to "put into any of the waters of this State where fish were taken, any offal, blood, putrid fish, or filth of any description," and imposing a penalty of \$300.00 for its violation.

Special acts were also passed regulating the manner of taking fish in the inland lakes in some of the counties. In 1871 the first general fish law was passed. It regulated the manner of taking fish, both in the Great Lakes and in the inland waters.

Still the depletion continued, and in 1873 a law was enacted "to establish a Board of Commissioners to increase the product of the fisheries, and to make an appropriation therefor." This act appropriated \$7,500.00 for the use of the Commission for each of the years 1873 and 1874 to cover all expenses, both the building of a hatchery and the necessary expenses of the Commission, and it was their duty "to supervise generally the fishing interests, and secure the enforcement of all the laws relating to the protection of fish and fisheries in the State."

No compensation has ever been allowed any member of the Board. They have served the State absolutely without pay. Uniformly men of broad gauge and thoroughly in love with their work, they have served the State faithfully and well, and the perfectly appointed hatcheries, with their beautiful buildings, the in-

land lakes and streams re-populated with the most desirable kinds of fish, stand as a perpetual monument to the earnest, intelligent work of the Michigan Fish Commission.

They have stocked our streams with trout and other game fishes, our lakes with bass, pike, perch, and lake trout. *They have also given us the German carp.* But in spite of the enactment of all these laws, the results were not entirely satisfactory. They were not enforced. Local officers winked at the most flagrant and open violations. The commercial fishermen used small mesh nets, and in the inland lakes and streams, spears, dynamite, and nets were used without danger of prosecution.

In 1887 the present president of the National Sportsmen's Association, Hon. A. L. Lakey, of Kalamazoo, introduced a bill "To provide for the appointment of a game and fish warden." Mr. Lakey had accepted the nomination and came to the Legislature for the sole purpose of revising the fish and game laws, and provide for their enforcement. He met with a most determined opposition, but succeeded in getting his bill through both houses, and it was approved by the governor, March 15, 1887.

The term of office of the State Warden is four years. A brief comparison of the conditions existing before the appointment of a Warden may be interesting. During the entire four years preceding the appointment of a State Warden, there was a total of fifty-six convictions in the State. During the four years' administration of Hon. William Alden Smith, the first Michigan Warden, 494 convictions were secured. During the year just closed—being the first year of the administration of the Hon. Grant M. Morse—867 cases were handled, with a total loss of only eighteen by acquittal. More than \$20,000 worth of nets and fishing appliances were found in illegal use, seized and condemned.

Thus is the work of the Fish Commissioners supplemented and aided by that of the Warden. It has been said: "He is indeed a public benefactor who causes two blades of grass to grow where but one grew before."

The Fish Commissioners of Michigan have accomplished more than this. They have increased the product of our inland

waters a thousand fold; our lakes are being carefully stocked; our streams are already full. The stocking of our Great Lakes with the rapid growing trout and the peerless whitefish is being systematically carried on. (They have seen the error of their ways and have abandoned the propagation of carp.)

Their work is beyond praise and the results obtained will forever remain commemorative of a philanthropic work well done, a stewardship faithfully kept.

And side by side with the encomiums passed upon the Fish Commissioners, will go forth the thanks of a grateful State for the forceful and splendid work of her State Game and Fish Wardens.

#### DISCUSSION OF MR. BREWSTER'S PAPER.

Mr. Ravenel: I take exceptions to every one of those reflections on the carp. Some private citizen in California introduced the carp, and I am very sorry that I did not look up the figures before I left; but I am under the impression that the introduction of the carp into various countries has been of more value to mankind than any other fish I know of. The catch is between fifteen and nineteen million pounds in this country, but the value I do not know. Carp are worth as much as bass in Illinois; in Philadelphia they are worth more than shad; of New York it is unnecessary to speak. I will say that they never bring less than  $12\frac{1}{2}$  cents a pound, whereas cod is sold at 6 cents. I believe to-day the prejudice against carp has practically disappeared, though in New Jersey it is a penal offense to plant carp in the waters of the state. In New York they sell millions of pounds, and it brings more than red snapper and shad. At one time last fall on the Illinois River millions of pounds of carp were being held by the fishermen for the market. The angler is largely responsible for the prejudice against the carp. He asserted several years ago that it ran out all other fishes. Two years ago we seined the canal that empties into the Potomac River near Washington, and we kept accurate account of the fish caught. We caught between 5,000 and 10,000 black bass

and only a few carp, and those were all large ones; we could not find any small carp. They said carp were there by the millions, but where had they gone? The bass had increased, but there was scarcely a young carp in the canal.

Mr. Davis: I have no statistics here, but I remember in regard to the value of carp caught in Lake Erie more than a year ago. Mr. Fred Dewey said that carp were a nuisance, that they caught them in their nets, and couldn't get any price for them; that they carried them out in the fields and buried them, and got rid of them the best they could. If they are worth so much more than black bass and whitefish the fishermen there should be notified that they are losing a good deal of money. I saw a while ago a piece in the paper about the carp driving out the black bass, and I understand the State of Minnesota was sued by somebody because the carp got onto somebody's meadow.

Mr. Dickerson: That was a suit begun against the United States Fish Commission. (Laughter.)

Mr. Ravenel: As far as the carp is concerned I would like to say that Mr. Davis can write to Dr. Bartlett and find out their value.

Mr. Dickerson: I go up to the Lake St. Clair "Flats" three or four times a week. In the shallow bays there, which are carp feeding grounds, bass have increased very rapidly in the past three years, and yet about every man I meet says, "Dickerson, I wish you could destroy these carp." Now the fact is, I think the carp is a benefit to the bass in those waters. Another thing, the carp does not thrive in the clean water that the bass does, and I really believe that the carp in a section like that is a benefit to the bass, as the young carp furnish a great deal of food for the bass.

Mr. Davis: Isn't it a fact that the carp is a great spawn-eater?

Mr. Ravenel: I wish I had Dr. Smith here. I do not believe that the carp is any worse than many other fish in that respect; nearly all fish eat spawn.

Dr. James: I remember some years ago, at the time when the carp was in its glory, everybody was putting carp in their streams. They were a rapidly growing fish, and a large fish, and had some value in the way of food. I watched some of the carp in a pond and stream on a farm I had along a large stream, the Rancocas creek, New Jersey. I put them in from two or three distributions before I succeeded in growing on account of local enemies in the ponds, and about all the people around that neighborhood who had streams of water planted them with carp. I studied up the subject pretty thoroughly and I found that these carp were great spawn-eaters. It was said that they ate nothing but vegetable food. I read a paper on this subject, stating that they were great fish spawn eaters, and would eat out the streams of their own spawn besides others, and I was laughed at because I deviated from the view that they were anything else but a vegetable eating fish. Well, that was at my expense, and now almost everybody, with the exception of a limited few, are against the carp. Who brought the original German carp here I don't know, but the United States Fish Commission had them and furnished them to us in large amounts, and I sent quite a large number of them up through New Jersey, and the Commission furnished many persons with them at that time when they were popular. That is my experience with regard to the carp. They do eat material to-day affecting the fibre, very much like the shad, which oftentimes become contaminated coming up the Delaware River, where there are a great many tanks of petroleum on its banks. Now, when the shad that are caught as they come from the ocean at the Delaware breakwater, down at Cape May—they lay around there for a while—those shad that come into the market are simply luscious. These shad come up the first of the season, before they get up to the polluted waters of the larger cities like Wilmington and Philadelphia, and there others become contaminated to a certain extent as they lay in waters receiving the sewage from the cities. I have thrown them off of my table on account of the petroleum taste, and I have also tasted the mud and sewage of the city in their fibre.



Our laws in Pennsylvania are food-fish protective. We have two of the larger streams running through the state, the Delaware and Susquehanna. Twelve or fifteen years ago, about fifteen perhaps, the value of the shad caught in the Delaware River was about \$75 annually, that is about the entire valuation of the shad that were sold; but by having the laws arranged so as to have a closed season, and by the system of hatcheries—we have a fine shad hatchery in Bristol where we propagated about ten millions of eggs this year—the income is now between \$700,000 and \$900,000, very nearly a million dollars from shad alone and \$43,000 from salmon.

The President: That is shad?

Dr. James: Yes, shad alone. Now that is simply to show how the laws can be made for one fish or for another or for all. I think by the laws of Pennsylvania we do not now plant any carp at all, but with brook trout and rainbow trout we fill the trout streams every year. About three years ago the legislature cut off our appropriation, but the year before we planted 105,000,000 of different kinds of fish, shad, bass and brook trout and all the varieties of good fish in the waters of Pennsylvania, and it just cost about \$35,000. Last year they were going to cut the appropriation down to about \$15,000. I happened to be up at the legislature at the last meeting and I plead with them to give us at least \$35,000, and I said the income of that \$35,000 will bring your state in nearly a million in the propagation of shad alone, and it is not so much the valuation of the fish as the amount of good food it gives our people. It is said here that the carp are more valuable than the shad. Why? Because we have so arranged as to the matter of hatching that there is such a great quantity of shad thrown on the market that the value goes away down, and the man who sells them does not want it down below a certain price, but the people do. We can feed thousands and thousands more people upon shad; it is very good food, but the value is kept up by those who catch them, and there the poor and rich come in contact as to the supply of food. We know that fish is on the menu of every hotel, and is one of the important

features of home meals, and we ought to keep the valuation down for the benefit of the masses of people. And for all these valuable food fish, like the shad, trout and bass, which our protective association, which I represent, is making efforts to have good laws enacted to protect from being seined out and is what we have been working for a great many years. Maryland occupies a large section for quite a number of miles across the Susquehanna River, and they allow fishing the entire year and they keep the upper streams from being filled with the spawn of the shad, and some other fish of that kind, but we cannot do anything with their State laws. We aimed to get a good law, a codified law, taking in all good features passed, but we found that the enemies of the fish came in and they had two bills by which they intended to upset all the laws that had been in operation for fifteen years. Instead of passing our own law we had to go up and fight their law—and I stayed there watching the thing myself—a committee went up two days before and said it was all right; but if I had not been there they would have passed two laws that would have killed all our legislation for fifteen years. Our chairman got hold of both bills, away on towards morning he put both bills in his pocket and went to the hotel and went to sleep and didn't get awake until too late to pass the inimical bills. That is the way we saved the good legislation, and the main feature of one of those bills was allowing fish netting for certain kinds of fish, for eels and things of that kind, but we knew what it meant—cleaning out all the fish they could. They were going to clean out for market and sale all our streams with nets, and the state propagating them for the angler, cannot maintain prolific streams.

We had a system in Pennsylvania of having a certain number of wardens, say 15 or 20, to cover the whole state. Well, about the time there would be some reported violation on the Delaware he would be off somewhere else, but the last legislature made this rule, and it was adopted, that any infraction of the fishing laws should be brought before a constable of the individual place in the county, and we thought we had every-

thing all right and that we could catch all these violators, but unfortunately the constable, when you told him of these infractions of the law, proved to be a friend of the very man who is violating the laws, and he doesn't prosecute them because they are friendly with him.

Mr. Dickerson: Mr. James says the shad are not contaminated until they get into Pennsylvania. I would like to ask if that isn't due to Pennsylvania politics?

Dr. James: Down in the Delaware they don't get into politics, but as soon as they reach the Pennsylvania line they get strictly into politics.

Mr. Bryant: Just a word upon the subject of the relation of the "Game Warden to Game Production and Propagation." In our State, Wisconsin, the Fish Commissioners have devoted themselves to the work of propagation and distribution. We have there a game warden appointed by the governor, who appoints an assistant, a deputy, whom he sends from one locality to another. Considerable is done there in that way for protection. In our principal lake, Winnebago, one of our best lakes, there has been practically a civil war, a body of fishermen along there being determined to fish whether or no, and the game wardens have fought them; that is, they have interested themselves in keeping the fish supply good, and we have made large distributions. But I may say that for weeks and months there has been a state of constant friction, and at every meeting of the legislature there are acts passed in regard to the fish and game laws. Now, our Fish Commission keeps out of trouble by not having anything to do with the laws for protection, with the result that the Fish Commission can get anything it wants from the legislature. If we want to establish a new hatchery, they ask how much we want, and they give it. Until the legislature of '99 sat, the railways of the state gave us transportation for our cars and employees, and all distribution was gratuitous; but we had a spirit of reform there, and they forbid the issuing of passes to any person in the state employ, and the result is that nobody can receive free transportation. The railway companies, however, will

send our cans and haul our cars free, and they give us mileage for a car, 40,000 to 50,000 miles a year; but in order to comply with the law, we are obliged to pay transportation for our men. The board, however, immediately made an estimate of how much that would cost, and the legislature immediately appropriated funds for transportation. We have found that by keeping the two systems separate, under two different departments, that propagation meets with universal favor; whereas, if we blended the two systems into one and the Commissioners of Fisheries were at the head of game protection, we would have a fight on that would take our whole time.

The President: And you wouldn't get any appropriation?

Mr. Bryant: And we wouldn't get any appropriation. Now, it is simply a question of how much we want, and there never is a whimper or any trouble. We always give them a fair estimate and indicate what we can do. We proceed economically. The Fish Commission does not get much time; we meet four times a year and go around and visit our hatcheries. Mr. Nevin attends to all administrative matters and carries out our resolves. There has been a great deal of talk, and we thought at one time that we ought to take care of the whole business, but experience taught us that all the fight comes on the nets, the size of the nets and what water shall be fished in, and what kind of laws. Of course much of our good work is thwarted by imperfect legislation, but it is better to have propagation going on undisturbed than it is to blend the two together and have both tipped over. The result is that we are, in that State, making headway all the time in securing better protection. The sentiment is growing but it takes so long to focus the belief of public sentiment against the sentiment of localities that it is a rough and stormy road to get any salutary legislation in that way.

A word in respect to carp. We are so well supplied with other fish in our state that the carp is looked upon as a visitation or a calamity. I think we are coming to perceive after all that the carp isn't so detrimental a fish. Within the last five years there has been a strong prejudice against the fish. They say

if you fill our lakes with carp you stock the lakes with hogs and do more harm than you ever did good; but our answer to that is, we always shoulder it onto the United States Fish Commission. (Laughter.)

In our state there is a lot of marshy, reedy, shallow water, hundreds and perhaps thousands of acres, and on the flats, within two miles of where I reside, at Madison, there are countless millions of carp, and the fishermen all say, when they hear them feeding, there is a lot of hogs, because when they are feeding they make as much of a rustle as a drove of hogs would. (Laughter.)

We are coming to find out that the fish have a special use, and do not diminish the other species of fish. I don't know whether the people living about the two lakes have carp, but they have pike fishing—wall-eyed pike and bass fishing. In our second lake there are all kinds of water, shallow water and deep, and they have the black and yellow bass, as the Oswego bass have a yellow hue. The fish are very abundant, notwithstanding a third of the lake, perhaps, is populated with carp thicker than Pekin is with Chinamen.

Dr. James: It is a fish they have a good word for in New Jersey, but I will say this: that New Jersey has but one special fish and game warden, who appoints others under him, and for the State of New Jersey that works admirably. This superintendent sees that the laws are enforced, and every month he publishes a little pamphlet, in which he puts down every infringement of every law, and sends out this booklet, and that has a good effect and a good influence in keeping the people from breaking the law. Our system in Pennsylvania is not so good, because we depend on the constable, and I think New York has something of that kind—very much the same system as ours.

## THE VALUE OF THE CARP AS A FOOD PRODUCT OF ILLINOIS WATERS.

---

BY DR. S. P. BARTLETT, QUINCY, ILL.

I take up this subject with a great deal of hesitancy, knowing what wide discussion it has caused as to its merits and demerits, particularly its demerits, and that the concensus of opinion may be opposite to mine; and who am I that I should attempt to refute such varied authority? But permit me modestly to preface my remarks by saying that I deal with the results of carp planting in Illinois waters alone. Here I know whereof I affirm, and I base my statements upon my experience only, and with profound deference to the opinions of those who may have reason to differ with me.

Without egotism, I think I can safely say that few men in Illinois have a more general knowledge of the waters of the state than I have acquired. Twenty-four years of active work in the Fish Commissions have taught me many lessons, and more than once I have been convinced that I have been all kinds of a crank in that time. The deductions of to-day may be diametrically opposed to those of twenty years ago, made under similar conditions, but with less experience to guide. From the investigations and experiments of the various fish commissions have come many practical results, not the least among which has been the introduction of the German carp. After the United States Fish Commission had increased its output of these fishes to an extent sufficient to give carload lots to the different states, I was instrumental in securing a carload for Illinois, and accompanied the car to the various points where the plants were made, and from these plants has come one of the largest factors in the yearly product of the waters of the state.

It would not be worth while to record here the flood of criticism that followed the introduction of this foreigner into Illinois.

waters. This is now only a bit of ancient history, seldom revived. I need only say that the press generally throughout the state made a vigorous "kick" against it, and legislation with a view to limiting the distribution was attempted; yet, while at first I may have had doubts as to the utility of the plant, I stood my ground, perforce, and defended the attacks against it. Public prejudice was largely augmented by the non-success of the many who attempted pond culture of carp, under conditions which would have made any different results impossible. The idea seemed to prevail that anything would do for carp, and starting with this premise, there were at one time six hundred carp ponds in the state, which consisted chiefly of holes in the ground filled with surface water, devoted not to the carp alone, but free to everything else on the farm—horses, cows, hogs, chickens, ducks and geese; and while even then some carp lived and grew, it may be imagined they were hardly fair samples of their kind, and added to these disadvantages, they were taken out for use regardless of conditions, at spawning time, and, when cooked, were, naturally, pronounced unfit for food. A few, practical enough to give them an even chance with other farm products by supplying conditions favorable to the best results, did well with them, and were well satisfied with their reward, but the experience of the many was made the criterion of success, and carp culture on the farm was voted a practical failure. The ponds made for them gradually broke down and the carp were carried through the creeks to the rivers and lakes, and here began their career of use and benefit.

For a great many years previous, on both the Illinois and Mississippi rivers, it had been the practice of fishermen and farmers, in the spring of the year, when the buffalo fish "rolled," to take them by shooting, spearing or with pitchforks, and packed in sugar hogsheads, they were shipped by river to St. Louis and other markets. Those that remained good were sold, the soft and tainted thrown away; the net results were, perhaps, from one-half to one and one-half cents per pound to the shipper,

and a loss to the community at large of thousands of pounds of good food. This improvidence continued, and up to 1880 the output had constantly decreased, until, from the best information we could obtain, only about one million pounds of buffalo were taken on the Illinois river in the season. They were simply "killing the goose that laid the golden egg," taking the buffalo at spawning time they destroyed not only the stock, but the increase as well, until the waters were practically depleted. This being the condition of things at the time of the introduction of the carp, it but remains to show how they improved their opportunity and became a valuable auxiliary to the supply of coarse fishes. For several years the carp were caught, but, having a bad name, the fishermen would have none of them, and they were thrown back into the water. This, as it proved, was fortunate, for they grew and multiplied and the fishermen finally awoke to the fact that there was a practically unlimited market for them in the east at good-paying prices, and began to utilize them. Year after year the catch of carp has increased, until careful estimates show that six hundred carloads of them were shipped east last season from different points on the Illinois river alone. The prejudice against the fish as food had gradually disappeared in this state, until now it is found in the fish markets of every town and village, and on the tables of almost every hotel and restaurant in the surrounding country.

For years, and seemingly to my misfortune, I was held responsible for the introduction and defense of this much maligned fish, and I have had plenty of newspaper notoriety as its advocate, but I have emerged from it triumphant, as it is to-day the universal opinion of every responsible fish dealer on the Illinois River that the carp was the best gift ever made by the United States Fish Commission to the people of the State.

There are natural reasons why the carp should be plentiful in the waters of our State. Not to take too much time, I will briefly say that the Illinois River, with its bottom lands frequently covering fifteen miles from bluff to bluff, abounds in low, flat lakes, into which the fish go with the overflows of the river, which



occur several times a year. The water of these lakes becomes very warm, yet there is sufficient depth to prevent bad results, and here the carp thrive, and from these lakes they are taken for market. The catches are so great as to savor strongly of the traditional "fish story," 25,000 pounds at a haul being not at all infrequent, and some catches have been made that would sound almost fabulous. I append herewith a statement or report of the Illinois River Fishermen's Association, which will give some idea of the financial value of this product to the towns along that river, and when it is considered that very many of the inhabitants of these towns depend upon the fishing industry for a living, the benefit of this replenishment of these almost depleted waters may be understood and appreciated.

Peoria, for instance, ships about two carloads of carp daily during the height of the season. They are packed in boxes holding 150 pounds net of fish. The fish are packed in ice and then placed in refrigerator cars, and not infrequently the fish still show signs of life on their arrival in New York, to which point most of them are shipped. Unlike the buffalo, which must be dressed and packed in ice for shipment, the carp are shipped "in the rough," that is, just as taken from the water, with absolutely no loss or shrinkage from the seine to the dealer, its admirable keeping qualities preserving its edible value perfectly.

At several points on the Illinois River, holding, or live-pens, have been prepared for storing the carp in until the market or the dealer is ready for them. Notable among these storage pens is one owned by Mr. John Schulte. The lake in which it is built is six miles long and averages one-half mile in width. Within this lake he has built a large enclosure, and the fish taken during the hot months are put into it and kept until the market is right, when they are taken out and packed for shipment. Mr. Schulte permits me to give one instance showing the results, financially, of a catch made by himself. The owner of a mill-pond wished to have the carp taken out of it, and gave Mr. Schulte the privilege of taking them. Mr. Schulte showed me a check for \$1,080.35 as the net result of the carload he took from that pond.

Buyers for New York houses are stationed at different points on the Illinois River all the time, and readily take all that is offered, just as it comes from the water, at a net price.

I give herewith a couple of letters received in reply to my question as to the value of carp:

Peoria, Ill., December 17, 1898.

HON. S. P. BARTLETT,  
Supt. U. S. Fish Commission,  
QUINCY, ILL.

DEAR SIR—In answer to your question as to my opinion of carp, will say, as I have often said, that the carp is the breadwinner of the fishermen and is a cheap food fish in big demand in New York, Boston, Philadelphia and Chicago.

The prejudice against the carp here at home does not apply abroad. Instead of carp being unfit to eat, scavengers living on any thing and everything, devouring the spawn of fine fish, etc., they are a fish of fair flavor for eating purposes, do not eat other than vegetable matter, such as grass, flag-roots, moss, etc., and never eat the spawn of other fish as the black bass does. Often I have heard it said that the carp are driving the fine fish out of the river. This is also far from the truth, as the carp lives in harmony with all kinds of fine fish. The only fish that does not seem to like the carp is the buffalo, and that is because carp are too lively for them and they cannot stand the jumping about of the carp, but if the buffalo have become scarcer, we have their cousin, the carp, to take their place.

In our dealings with our customers since the buffalo have become scarce, in filling our dressed fish orders we have had to substitute carp for buffalo very often. At first there was great complaint, and orders often read: "Don't send me carp if you have no buffalo." We kept on, however, substituting, and now many of the dealers who were so strongly prejudiced against carp order buffalo or carp, and many have written us to the effect that the people like them since they have given them a trial.

In summing up this carp question it can be truthfully said that the general opinion of the public on the question is purely imagination, and has no foundation in fact, and the best evidence of this is the wonderful demand for Illinois River carp from Eastern markets where they are sold for Illinois River carp, and not canned for "salmon," as many people believe.

Most respectfully yo

(Signed)

M. J. HURLEY,  
President Illinois Fishermen's Assn.

Havana, Ill., December 21, 1898.

S. P. BARTLETT,  
Superintendent U. S. Fish Commission,  
QUINCY, ILL.

DEAR SIR—You ask me as to crop of German carp and my opinion of their value.

As to the crop of young carp this season, will say that there is an enormous lot of them, and by next August they will be good, marketable fish, weighing from three to five pounds each.

The Fish Commission did a nice thing when they introduced the German carp in Illinois River. Carp are in great demand and find a ready sale. There is more demand for German carp than for all other fish taken from our rivers combined.

From the information I get, as an official of the Illinois River Fishermen's Association, from all points along the river the carp have brought more money than the catch of all other of our fishes combined. Long live the carp.

Yours respectfully,

(Signed)

JOHN A. SCHULTE.

From a commercial standpoint, then, there can no longer be any doubt as to the growing popularity of the carp, and as to one other alleged point against them, I would only say that their in-

roduction has not in any way lessened the angler's chances. Bass are more plentiful now than they have been before for years, and constantly increasing; so are the carp. There would seem to be no need for me to say more in refutation of the oft-repeated charge that carp destroy the bass and kindred fishes. I repeat, I am dealing only with what I know, and what I say applies only to Illinois waters. Possibly, in other places, carp may exhibit cannibalistic and murderous tendencies, but here they get down to business and make money, food and friends.

(Submitted in connection with Dr. Bartlett's paper on the Carp.)

To the Honorable Board of Fish Commissioners of the State of Illinois:  
**FOURTH ANNUAL REPORT OF THE ILLINOIS FISHERMEN'S ASSOCIATION**, compiled from reports received from the different shipping points on the Illinois River, giving the estimated amount and kinds of fish caught and value of same for the past year, ending January 1, 1900.

Shipping Point on Illinois River	German Carp POUNDS	Buffalo POUNDS	Cat-fish POUNDS	Bull Pounds	Sun-fish & R. Perch POUNDS	Striped Bass POUNDS	White Perch POUNDS	Crople POUNDS	Black Bass POUNDS	No. of Turtles Caught
DePue.....	50,000	100,000	1,000	4,000	1,200	900	4,000	1,000	545	2,000
Springfield.....	100,000	100,000	1,000	1,000	1,700	575	2,000	2,000	435	2,000
Union and Bureau Creek.....	85,000	150,000	2,000	7,000	2,000	1,375	4,000	2,000	435	2,000
Henry and Putnam.....	300,000	60,000	2,000	31,000	15,000	6,000	25,000	12,000	9,000	17,000
Chillicothe and Lacon.....	700,000	220,000	2,200	60,000	14,500	8,000	70,000	14,000	6,000	17,000
PEORIA.....	1,350,000	500,000	1,200	110,000	30,000	8,000	81,000	15,500	9,000	25,000
Pekin and Copperas Creek.....	360,000	100,000	1,100	49,000	27,500	6,000	2,000	13,000	4,000	18,000
Liverpool.....	80,000	65,000	18,000	18,000	7,000	1,650	15,000	2,000	4,000	6,000
HAVANA.....	1,193,990	400,154	18,000	94,100	37,000	13,205	43,280	18,500	12,061	28,000
Bath.....	100,000	100,000	8,000	16,000	23,000	7,000	14,500	12,000	2,070	16,000
Bluff City.....	85,000	61,000	1,000	5,000	18,000	500	8,000	200	400	2,000
Browning.....	475,000	368,000	45,000	5,000	28,000	3,000	8,000	2,000	1,700	4,000
HEARDSTOWN.....	700,000	700,000	24,000	59,500	28,000	12,000	49,000	10,000	4,100	18,000
North.....	150,000	150,000	1,000	1,000	1,000	3,000	3,000	1,000	2,000	12,000
Merita.....	100,000	90,000	1,700	1,000	16,000	1,000	4,000	1,000	1,850	1,900
Valley City.....	60,000	90,000	8,000	2,000	2,000	2,100	10,000	1,500	1,000	1,000
Pearl.....	90,000	120,000	20,000	1,000	1,700	1,500	10,000	1,800	1,400	6,000
Kempville.....	49,000	220,000	20,000	5,000	1,250	8,000	75,000	1,500	1,500	5,000
Hardin.....	22,000	146,500	19,000	5,000	1,500	1,300	15,700	2,000	1,000	4,000
Grafton.....	20,000	100,000	40,000	6,400	7,000	5,000	18,000	2,000	1,500	6,000
Pounds of each Species .....	6,332,990	3,143,154	241,000	499,100	252,050	92,931	459,580	114,490	70,221	202,900
Value by Species.....	\$189,980 70	\$941,294 62	\$9,640.00	\$19,964.00	\$7,561.50	\$4,646.55	\$13,787.40	\$6,869.40	\$7,022.10	\$8,471.50
	Pounds	Value								
Carp.....	6,332,990	\$189,980 70								
Cat-fish.....	3,143,154	\$941,294 62								
Bull Pounds.....	499,100	\$19,964 00								
Sun-fish and Ring Perch.....	252,050	\$7,561 50								
Striped Bass.....	92,931	\$4,646 55								
White Perch.....	459,580	\$13,787 40								
Crople.....	114,490	\$6,869 40								
Black Bass.....	70,221	\$7,022 10								
No. of Turtles, 202,900.....		\$8,471 50								
TOTAL.....	11,205,516	\$62,246 77								

GRAND TOTAL, { Pounds... 11,205,516  
 Value....\$62,246 77

M. D. HURLEY, President,  
 JOHN A. SCHULTE, Treasurer,  
 ALEX. SARGENT, Secretary, Peoria, Ill.

## **METHODS AND RESULTS IN CONNECTION WITH THE PROPAGATION OF COMMERCIAL FISHES FOR THE GREAT LAKES.**

BY FRANK N. CLARK, NORTHVILLE, MICH.

(Speaking) I will say, gentlemen, that this short paper was prepared rather hurriedly, as I have been very busy this season. I ought really to present you a better paper, considering the subject that was given me to write upon, because it is a subject that I should be familiar with, so if it is not what you might expect from the title, you will have to bear with me.

(Reading) Methods and results are correlative; they bear reciprocal relation. The success of the latter measures the degree of perfection in the former. Following this law I desire to make reference more particularly to results which, according to my belief, determine the practicability of methods employed.

To study in a thorough manner the results attending the culture of the commercial fishes of the Great Lakes would require complete statistics difficult to procure. It is not my purpose to elaborate on this subject, but to curtail and particularize, giving you only the summary of my observations on the line of whitefish culture.

The beneficent results accruing from the planting of whitefish fry in Lake St. Clair, Detroit River and Lake Erie by the Michigan Fish Commission of Detroit, by the Canadian Government, and by the United States Fish Commission station at Put-in-Bay, Ohio, are too evident to admit of doubt. The methods pursued and the results obtained in the waters of Lake Erie and tributaries suggest to my mind some practical facts worthy of consideration.

Reliable statistics will substantiate my statement that more than one-half the whitefish fry ever planted in the Great Lakes have been deposited in Lake Erie and tributaries.

The heaviest take of whitefish recorded last year to any water area of equal dimensions was credited to Lake Erie and Detroit River.

Fewer whitefish fry have been planted in Lake Ontario than in any other one of the Great Lakes; the value of its commercial fisheries suffers proportionately. The whitefish fishermen have practically abandoned the lake.

Statistics prove that whitefish were once more plentiful in Lake Michigan than in Lake Erie. According to figures from the Washington office of the United States Fish Commission the catch of whitefish in Lake Michigan in 1880 was on round numbers 12,000,000 pounds, while in Lake Erie during the same year less than 3,400,000 pounds were taken.

The conditions to-day are reversed. Since that date Lake Michigan has shown a gradual decline in that industry. During the year 1897 only about 4,000,000 pounds (in round numbers) were taken from Lake Michigan.

The whitefish industry of Lake Erie is being developed while that of the other lakes is hardly holding its own.

The whitefish industry of Lake Erie now ranks first and that of Lake Michigan follows.

There has been a gradual increase in the annual catch of whitefish in Michigan waters of Lake Erie since 1893, the take of 1899 being more than five times that of 1893 and more than twice as heavy as any previous annual catch for the past ten years; and it is probable that the catch has not been so good for twenty years or more. The statistics for Lake Erie (i. e., the whole lake) for 1899 are not yet completed, but they will undoubtedly show an increase of 50 to 100 per cent over the catch of the preceding year.

Reports from the fishermen (such information as I have gathered by letter and through conversation) seem to indicate that Lakes Michigan, Superior and Huron are holding their own fairly well and that there will undoubtedly be a slight increase over the catch of last year.

In Lake Erie a remarkable increase will be recorded for the

whole lake. The statistics for 1900 I have not, but during the five years between 1895 and 1899, inclusive, the United States Fish Commission planted in Lakes Superior, Michigan, Huron and Ontario a total of but 185,938,000 whitefish fry while during the same period the same Commission planted 443,677,000 in Lake Erie alone.

Thus it will be noted that the United States Fish Commission has planted in Lake Erie during the five years more than twice as many as in all the other lakes combined; in round numbers, a total of but 186,000,000 in Lakes Superior, Michigan, Huron and Ontario combined, and 444,000,000 in Lake Erie alone.

These figures, of course, do not represent the total plant for the five years; they do show what the United States Commission has done.

In addition, the States of Minnesota, Michigan, Wisconsin, Ohio, Pennsylvania and New York have made plants, and also the Canadian Government. Statistics show that prior to 1890 a total of 736,429,000 whitefish fry were planted in Lake Erie by the United States Commission and by the different State Commissions.

The superior condition of Lake Erie's whitefish industries I attribute to two chief causes:

(1) Very heavy plants of fry have been made; more than one-half of all the whitefish fry ever placed in the Great Lakes have been planted in Lake Erie.

(2) The fry have been planted direct from the hatcheries. The proximity of the hatcheries to planting grounds enables the planting of the fry at the right age. It is not necessary to haul them several hundred miles over land, they need never be held too long, and they can be planted at just the proper time and in the very best condition.

In other words, the bulk of the fry planted in Lake Erie and tributaries have been planted from adjacent hatcheries by tug with no bad effects from the act of transporting.

The refusal of the different railroad companies to hereafter



haul free the cars of the United States Commission is, with present facilities, at least a partial barrier to an elaborate and successful prosecution of the whitefish and lake trout work without tremendous cost.

The establishment of auxiliary stations, however, near suitable planting grounds on the Great Lakes would remove these difficulties.

The auxiliaries need not be run more than two months in the year; there would be practically no expense in transferring the eyed eggs from the primary stations to the auxiliaries. The people are now demanding results. In order to have them throughout the Great Lake region, the Lake Erie methods may well be extended to the other Great Lakes. This work is of a national character and should be prosecuted by the United States Government.

At present no other lake has such extensive facilities for the hatching and planting of artificially (so called) produced fry as does Lake Erie; note the correlative results. If the industry can be built up in Lake Erie, so it can in the other lakes by the application of like causes.

In consequence of the enormous expense to be incurred in future years by the movement of the cars to planting points, and in view of the more practical side of the question enabling us to plant by the outlay of less funds many more fry in better condition, it appears to me that an ever increasing population and an insatiable market will eventually necessitate the establishment of several auxiliary stations adjacent to suitable planting grounds on the Great Lakes.

By such practical provision the funds would be applied in the most direct way to the work of replenishment.

At Put-in-Bay the whitefish fry are dipped from the fry tanks into kegs as soon as hatched and immediately transported to natural spawning grounds on the reefs and there planted. The plants in Detroit River from the Detroit hatchery have been made practically in the same manner.

At the Detroit hatchery this past season no fry were held

longer than 24 hours; two large collecting tanks were used and cleared alternately of the fry every 24 hours.

The fry were admitted to the river through a large rubber tube extending below the surface of the water and connecting with a large iron tub on the deck of the tug; while the tug was moving slowly the fry were poured into the iron tub and they of course found their way through the rubber tube into the river, care being taken to keep the tub full of water and fry until the last of the fry were planted.

From a practical standpoint, it appears to me that there is but little opportunity for improvement in the present method of fry production. But if protected propagation is to provide also for the development of the output, there is a vast unexplored field before us.

Countless millions of fry can be called into existence by assisting nature to the mere extent of allowing her to assert herself unmolested, but when the fry stage is reached a far graver question stumps the student of modern fish-culture. The mere production of the fry, should the good work end there, availeth nothing; it is the maintenance of the same and the maturity of the living germs that really constitute the chief aim of our work.

Where shall the fry be placed in order that they may be subsisted and made to grow?

Truly they can be placed on natural spawning grounds and thus given an equal opportunity with nature's fry to battle for existence.

But who knows positively that spawning grounds are the true feeding areas for the newly hatched fry? In the first stages of reproduction the utter lack of solicitude, or even provident instinct, in the parent specimens resulting in such desolate waste (in nature's haunts) of the great reproductive possibilities so generously endowed by nature warn us and our investigation lead us to conclude it more than likely that not a single trace of anxiety is manifest in the parent fish for the well-being of the fry. When we consider the infinitely small percentage of fertilization in the natural state, and the lavish, reckless, extravagant

and wasteful manner in which the eggs are deposited, it leads us to infer that the instinct of the reproducers (adult specimens) can surely extend but little further than a promptitude to the selection of grounds favorable to the mere act of spawning. Whitefish and lake trout are not bed guarders, as is well known, and the eggs after being expelled from the body are forever discarded.

Then why should we accept it as conclusive that spawning grounds are really the proper places to deposit the fry from our hatcheries?

Then how could parent whitefish and lake trout evince sufficiently provident care to select a locality where less enemies abound and also consider the prevalence of abundant food for the resulting fry?

Is it not possible that all the necessary conditions are not favorable to any one locality? Then the work of the scientist is doubly necessary to determine the true planting grounds for hatchery fry. The character and formation of the honey-combed reefs, ledges of limestone rock, etc., that constitute the spawning ground for whitefish would seem strange for the predominance of minute life, either animal or vegetable. Grounds of this nature are practically barren of vegetation and consequently unfavorable to the development of fundamental water life.

Yet we cannot with certainty know that better planting grounds exist until practical investigations are consummated and the proper localities determined by scientific study into the plankton life with the food question in view. It is very natural to suppose that the predatory fishes are familiar with the location of the spawning areas of whitefish and lake trout, etc., and that there are decidedly better localities for the welfare and safety of the fry.

Although conceding, without a shadow of uncertainty, that the natural spawning resorts (with their rock crevices, etc.) afford excellent accommodations during the period of incubation, I shall continue to believe that better planting areas exist, until the fact is proven to the contrary. The solution of this question

would be a great stride towards the perfection of protective methods; no importance, however, should be detracted from necessary and co-operative laws essential to the re-establishment of the commercial fisheries.

The importance of scientific research is obvious, as the nature of the spawning beds is indicative of the fact that nature guides the parent whitefish there solely with a view to the protection and welfare of the ova, not the fry.

It has required the planting of many millions of whitefish fry in Lake Erie and tributaries to stem the tide of depletion and to reverse conditions but recently unfavorable to the ultimate re-establishment and maintenance of the industry on that lake.

In other words, vast numbers of whitefish fry, subsequently unaccounted for, have been liberated in the said Lake and tributaries.

Although the good results have come, there has been an enormous waste of fry somewhere. Is it necessary that such large quantities of fry must be destroyed every year in order that only a few more fortunate ones may reach maturity? This is beyond the scope of the practical fish-culturist. Can the scientist aid us by investigating into the causes of such wholesale mortality or destruction? Do the fry die of starvation or do they become food for predatory fishes?

The gratifying results from Lake Erie waters have not been produced without the application of wholesale methods, and necessarily enormous losses have been sustained and over-balanced by exceptionally heavy plants of whitefish fry. The same conditions may be brought about in Lakes Superior, Michigan, Huron and Ontario by very extensive planting, but it will certainly require that unless a solution of the food question and the location of better planting grounds be determined. By practical experiment it has been proven that Detroit River contains food favorable to the growth of whitefish fry, and the river undoubtedly affords excellent planting ground.

It is natural to suppose that by the current of the river the fry are brought in contact with the plankton life on their down-

ward course toward Lake Erie, and enter the lake through the influence of "a natural distributor," so to speak. From the Northville Station this past year we planted nearly 7,000,000 lake trout fry in Michigan waters of the Great Lakes. The number of pounds of lake trout caught during the year in Michigan waters of the Great Lakes is, in round numbers, about 7,000,000. Now, allowing that the fish would average five pounds each (which is a low estimate), just about 1,400,000 lake trout were caught during the year 1899. Now, supposing that of the 7,000,000 lake trout fry planted from the Northville Station one of every five reached maturity and averaged five pounds. It is readily seen that (should these proportions be kept up from year to year) the plants from Northville alone would keep up the supply of all the Michigan waters of the Great Lakes, the catch being regulated by the number of fry planted, to say nothing of the aid by natural production. And this allows for a loss of 80 per cent of the fry planted! These facts impress one with the thought that the work of the practical fish-culturist to the stage of fry production has about reached the limit of practical perfection.

The production of the fry constitutes only the fundamental operations of protected propagation; the maturity of the same is the consummation of the art, the result desired.

It is now a question of fry maintenance, rather than of fry production, that confronts us. It will eventually be solved, as "Necessity becomes the mother of investigation."

#### DISCUSSION OF MR. CLARK'S PAPER.

Mr. Bryant: Mr. Clark expressed doubt as to whether the planting of fry on the natural spawning grounds was the best place to make such plants. If you deposit fry there that are hatched artificially, wouldn't they have the same instinct as the fry that hatch on their own ground, and wouldn't they go to the very places, in search of food, as the fry hatched there?

Mr. Clark: What I would say in regard to that is, we know the whitefish are decreasing, except where the fry have been

planted in large numbers under favorable conditions, as in the Detroit river, which distributes them over large areas. Now, we do know that many of the best spawning beds of the whitefish have been destroyed and may not now be the best place to deposit the fry, if they ever were. For example, Thunder Bay, in Lake Huron, was formerly a natural spawning ground for whitefish, but it is not so now, probably on account of the sawdust and refuse spread over the bay from the Thunder Bay river. The main question is, do we get the results that we should from the number of fry planted?

Mr. Bryant: You deposit elsewhere than in the river?

Mr. Clark: Yes; certainly. For instance, take it at Alpena, we hatch between thirty and forty million that are distributed by boat from Alpena up and down the shore; perhaps fifty to seventy-five miles each way. Of course they are not scattered broadcast. The sum and substance of the thing is right here, Mr. President: We are working to some extent in the dark. I mean in the present years. We know to-day, Mr. President, that if we have 10,000,000 whitefish eggs we can tell just how many whitefish fry we are going to have one year with another, just how many fry, and I claim that that part of the fish-culture work has reached its limit. I claim that we have reached the highest practical limit in that direction. Now we want the scientists or somebody to step in and tell where the young fish should be planted to insure the best results.

Mr. Geo. T. Mathewson: I don't know anything about whitefish culture, but down in Connecticut we place the fish in ponds and hold them there. We are getting good results by taking our shad fry and putting them in our shad ponds and holding them there until October.

The President: I will inquire of Mr. Clark what he has to say on this subject.

Mr. Clark: Mr. President, that brings out the question of rearing fish for distribution. It is all right, I tell you, when it is practical. I would like to see it done, but how are we going to do it with the whitefish without an enormous expense? With the

shad you can do it only in a limited way. Neither you nor the United States Fish Commission have ever held 100,000,000 fry, and with the whitefish we must have the right kind of enclosures, and it means millions of money in order to do it right. (Applause.)

Mr. Davis: Isn't it a fact, Mr. Clark, that the disappearance of the whitefish is largely due to the increase of the fishermen's methods of taking them? We have one man who is fishing to-day with 75 miles of nets in Lake Michigan, and when there are nets in that lake that will extend around the entire area of the lake once and a half, is it any wonder that the fish are disappearing?

Mr. Clark: If you will read the papers and reports on this point, you will find that the theory we take is that the mature fish are there for the purpose of being caught out if you but replace with fry, and the food is there for the fry, if it hasn't been destroyed by sewerage and refuse. Now, when you replace with fry, you may take out all the adult fish; I don't care whether a fisherman has one net or 75 miles of nets. If this is not a fact, how is it that the whitefish are increasing throughout Lake Erie, where there is far more net fishing than in Lake Michigan. We caught last year, on the Detroit river, which all the Michigan men know, more than double the amount of whitefish taken there five years ago, and I do not think we had as many nets.

Mr. Ravenel: I would like to say to the gentleman from Connecticut relative to the distribution of the yearling whitefish, that the government would have to acquire property and build ponds, and it would be necessary to get the congressmen interested in it, and then after we have gotten the appropriation we must enclose an immense area to supply food for the young fish. The same question is involved in shad culture. We annually distribute millions of shad fry, and the supply of shad on the Potomac, where they have been raised to a considerable extent, has not been any better sustained than on the Delaware river, where only fry are planted. That is no argument, however; for the expense has been the only thing that has deterred us from under-

taking to raise more yearlings. It might be better, I suppose, to hatch 10,000,000 and raise them.

Mr. Stranahan's report for 1899 touches upon the question of fry distribution and suitable localities. He has made some very interesting observations. He claims that under certain conditions of the water the natural food of the whitefish is not to be found; that when the water was clear and cold he has made examinations and found the food in abundance, and he recommends very strongly that the planting of whitefish be governed by the condition of the water. Furthermore, whitefish are distributed over a very large area. They are siphoned from the hatchery into a large tank on a vessel, and as the vessel runs along at the rate of eight or ten miles an hour the fry run out into the water through a rubber pipe, so they are well distributed.

Dr. James: It seems to me that we are coming to the time when we will encourage the catching of all the older fish; that the time will come when with the fish that have once spawned, it will be a great deal better for the people to catch them. The laws which limit the catching of trout under a certain number of inches are right. Let all the older fish be caught and consumed by the people, but save the younger fish for propagation; give them a chance to spawn, that is my idea, and keep on propagating as we are now doing. The great trouble is to get uniform laws, but if you furnish fish five inches long and put them in the Pennsylvania waters they will all be snapped up. These fish get no chance; you get no good from them. You simply, by putting the fish there, feed the men who take them out, so we want to have a limit and permit them to do one spawning.



## THE CLOSE SEASON FOR FISH.

---

BY DR. B. W. JAMES, PHILADELPHIA, PA.

(Speaking): Mr. President and Gentlemen—I simply aim to call attention to a subject which I think we have not discussed in this society, and that is, “The open and closed season for trout and the better class of food fish.” It is a subject which should create some little debate, and I thought we might exchange views, so I wrote this brief paper, “The Open and Closed Season for Fish, Birds and Mammals, More Particularly Fish.”

(Reading): Next to the subject of the size of the various fish to be caught comes that of the open season for their catching, and the close-season for their spawning, and we can easily see that this will vary in different States and streams of this continent on account of the variation of the temperature between the Canadian streams and the warm shores of the Gulf of Mexico, and the State laws will vary a little. While there is some variation due in this way, there is still a period within possibly two or three weeks at the very farthest of variation only to be allowed for those fish which populate different streams, such as shad, salmon, herring, etc., while the brook trout, which usually inhabit cold localities, and of course do not exist in streams of the lower portion of the country, might be said to require almost a uniform period for the close-season. The period in three or four of the States into whose interior the larger streams extend, such as the Hudson in New York, Delaware and Susquehanna in Pennsylvania, and others in Maine, Massachusetts, Connecticut and other States only will be referred to. In the State of Pennsylvania we find the following law in force:

OPEN SEASON FOR GAME AND FISH IN THE STATE OF  
PENNSYLVANIA—1899.

FISH.	LAWFUL TO KILL.
Black bass and all others'.....	May 30 to Jan. 1.
Sea salmon.....	March 1 to Aug. 15.
Speckled trout.....	April 15 to July 15.
Speckled trout, Pike County....	May 1 to Aug. 6.
Lake trout.....	Jan. 1 to Sept. 30.
Pike or pickerel.....	June 1 to Feb. 1.
Susquehanna salmon.....	May 30 to Jan. 1.
Shad.....	Dec. 31 to June 20.

In regard to birds and mammals it is lawful to kill—

Elk, wild deer or antelope from Nov. 1 to Dec. 1.

Gray, black or fox squirrel from Oct. 15 to Dec. 15.

Hare, commonly called rabbit, from Nov. 1 to Dec. 15.

Quail, or Virginia partridge, from Oct. 15 to Dec. 15.

Rail birds or reed birds from Sept. 1 to Dec. 1.

Wild turkey from Oct. 15 to Dec. 15.

Ruffed grouse, commonly called pheasant; or pinnated grouse, commonly called prairie chicken, from Oct. 15 to Dec. 15.

Upland, or grass plover, from July 15 to Jan. 1.

Wild fowl from Sept. 1 to May 1.

Woodcock, during July only, and subsequent season, from Oct. 15 to Dec. 15.

The main features of our Pennsylvania State laws are as follows:

Sunday shooting is prohibited under a penalty of \$25.00.

"There shall be no hunting or shooting on Sunday, penalty \$25.00. That it shall be unlawful to kill, entrap or pursue with intent to kill, any elk, deer, fawn, wild turkey, pheasant, grouse, quail, partridge, or woodcock for the purpose of selling the same, or to ship any of the above game out of the State; penalty, \$100.00 for every elk, deer or fawn so taken, purchased or sold, and \$25.00 for every wild turkey, pheasant, grouse, quail, partridge or woodcock. Unlawful for any one person to kill in any one day more than 15 quail or Virginia partridge, or more than 10 woodcock,

or more than 10 ruffed grouse (commonly called pheasant), or more than 2 wild turkeys, or to kill in one season more than 2 deer. Unlawful to use dogs in hunting for deer, under a penalty of \$100.00. Dogs pursuing deer may be killed. Hunting rabbits with ferrets prohibited."

The general features of our fish laws in the same State may be found summarized in the fifteenth annual report of the Pennsylvania Fish Protective Association, and is as follows:

#### SUMMARY OF FISH LAWS.

**Nets and Set Lines.**—Fishing with nets in the inland waters, and set lines, is positively prohibited by the laws of this State. Penalty, \$100.00, with forfeiture of nets, boats, etc.

**Fish Weirs, Etc.**—Fish weirs, fish baskets, and Fyke nets are prohibited by the laws of the State. Penalty, \$50.00 for first offense, and \$100.00 for second offense.

**Dynamite and Explosives.**—The use of torpedoes, giant powder, nitro glycerine, dynamite, electricity, lime or any other poisonous or explosive substance of any kind for catching or taking fish is strictly prohibited. Penalty, \$50.00 and imprisonment.

**Fish Under Size.**—The catching of black bass and wall-eyed pike under six inches, and trout and rock bass under five inches in length, is prohibited in any of the waters of the State except the Delaware River, where it is illegal to take black bass or wall-eyed pike under nine inches in length. Penalty, \$10.00 for each fish.

Penalty, \$10.00 for each bass, speckled trout, lake trout, Susquehanna salmon or wall-eyed pike, pike or pickerel taken out of season.

Penalty, \$20.00 for each sea salmon taken out of season. Those under three pounds must be returned to the water.

Fish wardens, constables or any officer of the State, are authorized to arrest without warrant any person violating any of the fish laws. One-half of the penalty goes to the informer.

In our neighboring State of New Jersey we find the following laws in force, as given by the Board of Fish and Game Commissioners:

# OPEN SEASON FOR GAME AND FISH IN THE STATE OF NEW JERSEY—1899.

FISH AND GAME.	LAWFUL TO KILL.
Hare, rabbit and quail.....	Nov. 10 to Dec. 31.
Woodcock.....	July, Oct., Nov. to Dec. 10.
Gray, English or Wilson snipe..	March, April and Sept.
Partridge, grouse or pheasant..	Oct. 1 to Dec. 10.
Reed bird, rail bird or marsh hen.	Aug. 25 to Dec. 31.
Gray, black and fox squirrels....	Sept. and Nov. 10 to Dec. 10.
Grass or upland plover and dove...	August and September.
Geese, duck and other web-footed wild fowl.....	Jan. 1 to May 1 and Sept. 30 to Dec. 31.
Brook trout.....	April 1 to July 15.
Black bass.....	May 30 to Nov. 30.
Pickereel.....	Jan. 1 to Feb. 20, and May 1 to Dec. 31.

The killing of deer and long-necked pheasants is prohibited at all times.

The Forest, Fish and Game Laws of the State of New York may be summed up briefly, as follows:

"Trout, close season.—The close season for trout shall be from September 1st to April 15th inclusive. Trout shall not be sold or possessed in any county during the season that is closed throughout the entire county. Trout less than six inches in length shall not be taken or possessed, and if taken shall without avoidable injury be immediately returned to the waters where taken."

"It is unlawful to take fish or game during the time described as 'close season.' Fish and game for which close seasons are established may be hunted and caught in a lawful manner during that part of the year which is not included in such close seasons respectively. The 'open season' is that part of the year when they may be taken in a lawful manner."

"Close season established in towns.—The commission may, on the request of a majority of the town board of any town in

which fish have been or shall be placed at the expense of the state, prohibit or regulate the taking of fish from public inland waters therein, for not exceeding five years, from the first of May next after such fish have been furnished. At least thirty days before such prohibition or regulation shall take effect a copy of the same shall be filed in the office of the clerk of the town to which the prohibition or regulation applies, and printed copies thereof at least one foot square shall be posted along the shores of the waters affected not more than fifty rods apart."

CLOSE-SEASON FOR FISH IN THE STATE OF NEW YORK.  
1900.

FISH.	UNLAWFUL TO KILL.
Trout.....	Sept. 1 to April 15
Lake trout.....	Oct. 1 to April 30
Black bass.....	Jan. 1 to June 15
Pickereel and pike.....	March 1 to April 30
Muskalonge.....	March 1 to May 30
Salmon.....	Aug. 15 to March 1

The examples of these three states will probably give about the average for the Eastern and Northern States, and as I have not the data from other states which is required for a complete paper on this subject, I will simply bring out the points which seem most worthy of debate in the different states at the present time, and the imperfect workings of the laws which are not harmonious in the different commonwealths.

For instance, we find in the Philadelphia markets, extending over quite a season beyond the limit set for the killing of certain game and fish, an abundance of such upon the market stalls, for a considerable time after our close-season; the law simply prevents their being caught and killed here, while just across the border the close-season may extend to two, three or four weeks longer than ours, and they could be thus and are unfairly sold in our markets on account of such an extended season. This point, however, the commissioners and those interested in the enforcement of our fishing and game laws are aiming to prevent by having an enactment passed which will prohibit their sale or

use beyond the exact requirement of the state law on the subject. This should be done in all the states in order that uniformity may prevail in a matter so important to the fishing interests of the individual commonwealths.

At the last session of the Pennsylvania Legislature we aimed to have the length of trout and some other fish limited to one or two more inches. Brook trout, now 5, we wanted 7 inches. But the opponents of good legislation aimed to pass bills which would open the streams to netting and similar methods of depopulating the waters which the fish commissioners had propagated and placed there for keeping the streams well stocked, and as we all know this stocking cannot be effectively done unless there is a protective law against the cleaning out by nets of the fish which the fish commissioners, through their propagating stations, are constantly keeping well supplied by annual delivery of fry to the different streams for the various kinds of fish throughout the State, the subject of the close-season is a vital one for our consideration, to bring out and show the differences to which I have referred. It is to evoke valuable discussion on this subject that I have prepared this brief paper.

#### DISCUSSION OF DR. JAMES' PAPER.

Dr. James: Why we aimed to get the legislature to change the trout from 6 to 7 inches was that we wanted the trout to get time enough to spawn for one year, but the legislature would do nothing for us at its last session—meeting every second year only—we have had to leave the short five-inch trout to be the rule. We thought we could get a six-inch limit, and then at the next legislature seven, but failed.

We aimed some years ago, and this society had a committee appointed, Mr. President, whose duty it was to ascertain if the legislatures throughout the country would not enact uniform laws, but we found a great difficulty to get them to do what was wanted, and that is what we find in regard to this matter now, still it is a subject which we really ought to take up again and see if we cannot come to some conclusion in regard to uniformity in this matter all over this country at least.

Mr. Brewster: The laws of the State of Michigan get at that very nicely. By an act of the legislature of '93, one of the sections states that "it shall be unlawful to sell or offer for sale, or have in possession for the purpose of sale, any birds, game or fish," and their sale was prohibited by the State of Michigan in any case. That was afterwards modified to cover the sale after the closed season began.

The President: I will inquire of Mr. Brewster how he gets along with the stock of game or fish on hand when the close season begins, supposing that at the end of an open season on the grouse or deer, parties have them in their possession.

Mr. Brewster: By another section they are allowed to have them in their possession, but only for their own consumption, and in all cases it is for the defendant to prove that they are in his possession for that purpose. The sale of quail and partridge is always prohibited in the State of Michigan; they are not allowed to be sold at any time.

The President: You keep the cold storage plants closed up in those respects?

Mr. Brewster: Well, that is the law. I think it is as well observed as almost any other police regulation. Of course there are some cases where prosecutions have been had and held against cold storage. Within the last year the cold storage and game houses were cleaned out thoroughly. I don't remember exactly what quantity was taken. Mr. Morse is here and knows, but a very large quantity was condemned and turned over to the state institutions for their use.

**MICHIGAN GRAYLING.****(Thymallus Tricolor.)**

---

BY A. C. BABBITT, WILLIAMSBURG, MICH.

Dr. Henshall's papers on Montana grayling were deeply interesting to me, carrying my thoughts backward to a time when Michigan's type of the species—*Thymallus Tricolor*—were almost the sole occupants of at least one thousand miles of limpid, running spring water, of varying width and deepness, threading the pine-clad sections of twenty-three counties of the Peninsular State lying north of a line drawn from the south line of Oceana County, on Lake Michigan, running northeasterly to the lower side of Arenac County, on Saginaw Bay. In the early seventies most of the streams and tributaries in the following list were literally overstocked with grayling. The northern portion of Arenac County is traversed by the Au Gres River, which mingles its waters with those of Saginaw Bay. From thence north, flowing into Lake Huron are the Au Sable, Black, Pigeon and Sturgeon Rivers, besides two branches of the Thunder Bay River—the Rainy River and Canada Creek. From the apex of the peninsula south, the waters of Lake Michigan receive those of the Maple, Boyne, Jordan, Boardman, Manistee, Little Manistee, Pere Marquette, White and Muskegon Rivers, all of which were originally the home of grayling. The one grayling stream of the Upper Peninsula is the east branch of the Ontonagon River, which empties into Lake Superior west of Keweenaw point. By coast line the mouth of the Ontonagon is upwards of four hundred miles from the coast to the Lower Peninsula. On account of the strictly non-migratory habits of the Tricolor it would seem that the Ontonagon specimen should receive a separate classification.

My acquaintance with grayling dates from the winter of 1872 and '73. A year or two previously Dr. J. C. Parker, of Grand



Rapids, had identified the species, from specimens taken from one of its most southerly habitats, Hersey Creek, a branch of the Muskegon River.

We early settlers of Crawford County, however, were ignorant of the fact, and many long evenings were partly taken up with discussions as to the identity of the fish with which the streams of that county abounded. Supposedly a species of trout, its specific name depended on the particular stream from which it was taken. In that locality it was generally designated Au Sable or Manistee trout. By some, however, it was claimed that this stranger was no trout at all, but more likely a "cisco" or "jack salmon;" while others, wiser in their own conceit, pronounced this *rara avis* a "cross between a sucker and lake herring." In 1875 the upper portion of the Au Sable and Manistee rivers retained yet their primal beauty; their stock of grayling was practically intact; a catch of fifty pounds was not an uncommon thing as a result of one day's fishing with a fly rod. By this means the demand from Chicago, Cincinnati and Detroit for grayling was over-supplied, so little was this delicious table fish known. As its fame as a game fish and an epicurean dainty spread, fishermen came from afar, who almost invariably pronounced it superior to brook trout in both of these qualities. It is to be hoped that an effort will be made to propagate *Thymallus tricolor* by methods similar to those employed in the propagation of its congener in Montana. Two questions in regard to *tricolor* have for some time engaged the attention of fish culturists: First, inquiry as to the cause for the rapid depopulation of grayling streams; second, why have attempts at artificial or protected propagation of the species been economic failures? Owing to the gregarious and fearless nature of *tricolor*, I believe that the same amount of fishing on a grayling and trout stream of similar character would make a greater impression on the stock in the grayling stream than in the trout stream. The real cause for the practical extermination of Michigan grayling, however, has been logging operations.

On account of their peculiar spawning habits, the log drive

has, year after year, practically shut out that function, besides undoubtedly destroying numbers of adult fish.

Tricolor habits are, for ten months in a year, strictly local. During this period he will occupy a portion of a river bed circumscribed by one square foot of space. No matter if hundreds are domiciled in a bend of the river, each and every one keeps separate house. If disturbed, driven out, each returns to the precise spot which he formerly occupied. About the 10th of March there is a general exodus from their haunts, a run down stream. When nature prompts their return they begin a lingering ascent or up run, performing spawning functions on the way up stream, at points for which the gravid fishes have a special predilection, on either sand or gravel, according to the character of their habitat.

Tricolors' habits or preferences are immutably fixed, as unchangeable as fate—she has a preference for a particular portion of the river's bed on which to spawn and there she will deposit her ova or not at all. If a log jam rests on the spot of her choice—as is often the case—being piled from the bottom to the surface of the water, she will hold onto her eggs until the germ dies, rather than cast them in any other place. These traits render it an impossibility to propagate the species anywhere else but in their native haunts.

In short, the Michigan type of *Thymallus* must have a down run. She must also find her spawning ground unobstructed on her return, or propagation of her kind is off for that season. The experience of several years devoted to efforts at domestication of grayling convinces me that it is impracticable.

I believe, however, that protected propagation of *Thymallus tricolor* is both practicable and feasible; provided a stream can be found where logging operations are a thing of the past, and where enough grayling have survived to serve as a nucleus for future operations under the protection and manipulation of fish-culturists.

## HINTS ON GRAYLING CULTURE.

---

DR. JAMES A. HENSHALL, BOZEMAN, MONTANA.

The successful culture of the Montana grayling and the safe transportation of grayling eggs, under proper conditions, are no longer matters of experiment. My first attempt, two years ago, to hatch and rear the grayling on the same lines as those usually pursued with trout, was almost a total failure, owing to a lack of suitable conditions and a want of experimental knowledge concerning the character of the eggs and habits of the fry.

The published accounts of the experiments of Seth Green and Fred Mather with the Michigan grayling in 1874 were both meager and unsatisfactory, and availed nothing; nor was I able, subsequently, to obtain any additional or definite information on the subject from Mr. Mather, who seemed to have forgotten all the details connected with his experiment. Both Green and Mather pursued the same method in hatching and feeding the grayling as with brook trout, which leads me to doubt that either of them succeeded in rearing the fry.

In the first place, grayling fry cannot be reared in the hatchery in cold spring water, owing to its low temperature, and the entire absence of natural food; for neither air nor food exists in spring water as it issues from the ground. Neither can the fry be induced to take the artificial food generally used for trout fry, to any great extent, in the hatching troughs.

In my first experiments I was much chagrined and discouraged at seeing the diminutive organisms curl up and drop dead to the bottom of the trough, notwithstanding a great variety of substances had been offered, to induce them to feed.

At this time I was impressed with the apparent resemblance of the grayling fry to the lake whitefish fry, both in size and appearance, which led me to think that they also required similar food. Upon examining the fry under the microscope I discovered

that my surmise was correct, inasmuch as the grayling fry had two fang-like, retrorse teeth, in the upper jaw, similar to those in the lake whitefish fry. This fact at once solved the problem. It was imperative that they be supplied with such natural food as is found only in the water of streams and lakes.

Acting upon this hint I turned all the remaining fry into a sheltered, shallow bight of the creek that flows through the hatchery grounds. There they did well for several weeks, when they sought other portions of the stream.

In the following autumn I constructed a large pond and supplied it with creek water by a ditch 1,500 feet in length. From this pond I supplied the nursery ponds with creek water. By holding a glassful of this water to the light hundreds of small crustaceans (*Entomostraca*) could be observed, appearing to the naked eye like specks of dust, and this was just what the grayling fry needed, as my subsequent experience proved\*

Another desideratum to be considered for grayling fry is the warmer temperature of creek water as compared with spring water. They also need sunshine. While trout fry usually seek the shady side of the ponds, grayling fry prefer the sunny side.

My method is now to transfer the fry, as soon as they begin to swim on the surface of the water in the hatching troughs, and before their yolk-sacs are entirely absorbed, to the nursery ponds. They take kindly to the change, and at once begin foraging for their natural food of crustaceans, insect larvae, etc. They are extremely active for such small organisms, and pursue their minute prey unceasingly. Soon thereafter they can be taught to take liver emulsion, and still later they begin to eat each other, for they are as much addicted to cannibalism as the pike-perch fry. The only remedy for this proclivity is to provide twice as many fry as it is desired to rear, and as soon as practicable to separate the larger from the smaller ones.

---

\*The temperature of my spring water was 45°, and of the creek water, 50°. The importance of creek water is not so much a matter of temperature as that it contains the natural food required for grayling fry in its earlier stage of existence. As a matter of course a temperature of from 50° to 60° Fahrenheit is desirable with fry of any species, in the rearing trough or nursery pond.

In stocking streams with grayling fry it is my opinion that they should be planted within a few weeks after they are transferred to the rearing ponds, or even so soon as they begin to swim freely, as is done with lake whitefish fry—provided that suitable places be selected in the stream. Shallow, weedy situations in the eddies or back water of the smallest tributaries should be chosen. There they would find their requisite food, and be safe from the depredation of larger fishes.

At our grayling auxiliary station some two million fry are planted each season in the adjacent creeks as soon as they begin to swim, and the result is very apparent the following autumn, when the waters fairly swarm with grayling fry several inches long. The grayling is quite shy, and a wilder fish than the trouts, and can not be so easily tamed—another reason in favor of their being planted early in life.

A very important matter to be considered when the fry are placed in the rearing ponds, is to see that there is no leakage in the drain boxes, and that the screens are caulked in their grooves, and the screens themselves reinforced by perforated tin of the smallest calibre, otherwise many fry will escape. I have lost thousands from leaky outlet boxes when, apparently, they were perfectly tight. But as grayling fry will worm themselves, at first, through a pin-hole, it is evident that the utmost caution must be observed to prevent their escape.

#### TRANSPORTATION OF EGGS.

Previous to the present summer I have had considerable trouble in shipping grayling eggs safely. The period of incubation being so short, and the shipment occurring during hot weather, it seemed impossible, with ordinary means, to transport the eggs to a distance without a loss of 25 to 90 per cent, owing to the high temperature to which they were subjected en route.

Heretofore we have used the ordinary egg-shipping case, which, while answering well for trout eggs, has proved a failure, even when well supplied with ice, for grayling eggs. Last winter I devised and built a refrigerator case that has proved to be just the

thing needed. A brief description of this case may not be amiss: The outside box is 30 inches square, and from 12 to 18 inches deep, according to the number of eggs to be carried. An inner wall of light stuff, say one-half inch thick, of the same depth as the outer box, and 27 inches square, without top or bottom, is provided. The space between the outer and inner walls is packed tightly with dry sphagnum moss or dry sawdust. The stack of egg-trays is placed in the center of the box, leaving a space of about five inches between it and the inner wall, which is filled with broken ice. On the top of the trays is a hopper with perpendicular sides, four or five inches deep. The vertical sides of the hopper allow free access to the ice-chamber around the stack of trays. The trays are 12 inches square on the outside, and but  $\frac{1}{2}$ -inch deep. This permits twice as many trays in a stack as with the ordinary trout trays. The eggs are placed in a single layer on each tray, and covered with a piece of mosquito netting in the usual way, but no moss is placed over it, as grayling eggs will not admit of as much pressure as trout eggs; the outer membrane of the eggs is quite thin and easily ruptured. By this method of packing, the eggs are received at Bozeman station in as perfect condition as they leave the auxiliary station, after being subjected to a wagon haul of 45 miles and 250 miles by rail, and at a temperature not exceeding 40° F. This has been, also, the condition in which they arrived at distant points, according to reports received, even, as in some cases, when they were en route a week.

As a matter of experiment, several trays of eggs were shipped but six hours after fertilization to Bozeman station, with the result that fully 25 per cent of the eggs hatched; heretofore similar experiments with green eggs resulted in the loss of all the eggs before their arrival. By maintaining a temperature not to exceed 40° F. the development of the embryo is retarded, and the eggs can be safely shipped to any distance so long as this condition is observed. It is my opinion that grayling eggs can be safely shipped within one or two days after fertilization, but this has yet to be determined by experiment. Should this prove to be true, it will be an important factor where the eggs are to be shipped a long distance, requiring several weeks for the journey.

DISCUSSION OF THE GRAYLING PAPERS.

The President: Gentlemen, have you any remarks to make about these papers on the grayling? I am sorry the gentlemen are not here to answer questions. I want to inquire if any gentleman here has had experience with them, so that they can say what is the most natural temperature for them? I infer that the fry thrive best in a high temperature, and my experience is that the fry do best at about 70 degrees.

Mr. Ravenel: That is sustained by most of those who have received shipments of eggs from us, and I think most of the shipments were received in good condition. At the Duluth station Mr. Wires hatched them in jars; after the fry were all hatched they were poured out on trays. He suffered a heavy loss on account of a sudden rise of temperature, that would have had no effect eight or ten days later. He held them in the Duluth hatchery until the water attained 70 this spring. The change of temperature came just as they were commencing to take food.

The President: May I inquire what you know about the normal temperature of the water where the grayling are indigenous?

Mr. Ravenel: I think the average temperature at Red Rock Lake was 52.

Mr. Bryant: Is there any difference between the Montana grayling and the Michigan grayling?

Mr. Ravenel: I think so. I think Dr. Henshall states the difference, and there seems to be a difference in their spawning habits. The Montana grayling is as easily spawned as a trout.

Mr. Bryant: Which of them is different from the European grayling?

Dr. Smith: Both of our grayling resemble the European grayling very closely; but whether the Montana or Michigan species is more closely related to the European, I can't say.

Mr. Clark: Mr. Chairman, just a word. The Michigan grayling, if caught wild during their spawning season, spawns as readily as trout or any other kind of fish, and gives good hatching results; this was demonstrated on the Au Sable and Manistee

rivers a number of years ago, when something like 50,000 eggs were taken and hatched. But these grayling will not domesticate and mature their spawn when held in ponds.

We have at Northville at present some grayling that are between seven and eight inches long, raised from eggs from Montana. We do not introduce warmer water because they seem to require it, but for the food. These fish were held in troughs until September, supplied with a mixture of spring water at 53 and creek water at 72 or 73, but the creek water was used only for the purpose of adding to the supply of food. Since then they have been in a pond fed with spring water at 53, going down perhaps to 48 in the winter.

The Secretary: I do not think the water should necessarily be as high as 70 to get the best results. Take the Au Sable, once a famous grayling stream, as an example. I have taken the temperature of that stream in the month of August, when the water is about as warm as it ever gets, and it ran from 55 to 60. I did not find it above 60 at the hottest time in August, though it was probably warmer farther down stream. I can't say what the temperature is in April and May, when the fish are spawning and hatching, but it must be a good deal lower.

Mr. Ravenel: I think 60 is a very high temperature in the Au Sable, but Dr. Henshall's whole claim is that they should be transferred to a warmer water just before they commence to feed. It wasn't because he wanted warm water, but because of the conditions that the warm water produced.

Mr. Nevin: I would say that I saw those grayling at Duluth, and I never saw trout eat more ravenously than they did.

Mr. Thompson: We have some grayling at the Nashua station that have been fed nothing but liver. We took some of them out doors and some were left inside in water of 48 temperature—the water outside was 60. Those inside did not seem to have much desire to eat, while those outside ate very readily. We prepared the food, of course, with very great care and also placed them just below some troughs of brook trout we were feeding. The water from the brook trout passed right through



the grayling troughs. We all know that in feeding trout they take the larger particles, and that there is a very fine emulsion that passes through the trough. Our idea was that this would furnish a great deal of suitable food for the grayling, which seemed to be the case, for the one trough outside grew very well. In the hatchery we found difficulty in getting them to take food in sufficient quantities. We transferred them outside, made the conditions the same as with the others, and we can tell by their size in each trough now the relative time at which they were transferred into the warmer water. We fed them at first about six times a day, and found apparently we were not feeding them often enough. Those that got the six feedings and the food from the trout troughs above grew very rapidly, but those that only got the food six times did not thrive. We increased the number of feeds and they seemed to respond very readily. We have some of the fish now, the largest ones about an inch long.

The President: This seems to be quite an experience on the grayling, and the subject being new, I trust you will pardon me if I give my experience. We hatched in spring water, piping the water direct from a spring, and my pipe was set up under a tent because I wanted water free from sediment. As the fish hatched we moved them down into the hatchery, with the exception of one trough, which we kept supplied with spring water, not from the spring direct, but from a distributing box. We had connected with that same spring box three other rearing troughs filled with brook trout. The grayling in this one spring box were fed but did not take food readily in a low temperature (of about 48 degrees). They would take very little food, and we lost nearly every fish, and we finally moved two or three hundred fish down into the hatchery. The water in the hatchery is a mixture of river and spring water, and we found from the locations of the different troughs, that the little fellows seemed to do best in a temperature of about 70 degrees. All of these fish were fed on emulsion of liver. When they first began to take food we took our finest liver and set it in a pan of water, and then skimmed off the top for the grayling and let the thicker

portion settle down, and then as they developed a little they would take all the food which we naturally give to the young trout fry and strained it, and all of our grayling have been fed entirely on liver; you might say, they have had no artificial food because all of the troughs in which the grayling are kept are below the troughs in which we have the trout fry. The water passes through the trout box before it reaches the grayling. I think the grayling is the most rapid grower of any fish I have ever had in the hatchery. They have trebled in size since we got them in May. Our experience last season wasn't successful because we got our eggs before they learned how to pack them properly; we only hatched a few, but those fish in the middle of the summer were larger than our trout fry, which were several months older. We have some yearlings and these fry. I think though some of them have disappeared inside of the others for their numbers have decreased—they have gone somewhere.

Are there any further remarks on the grayling?

Mr. O'Malley: I had an opportunity while in Leadville of seeing the grayling carried there and attempted to be reared in that cold water. When I left there the grayling were about a year old, and at that time they were hardly an inch long, and I think according to that it would tend to show that they do better in hatcheries having warmer water. They didn't seem to feed.

Mr. Bryant: I want to ask the Michigan gentlemen about their living in the water with other fish, do they monopolize the stream?

Mr. Willard: I think I can answer that question. I spent the summer of '97 fishing for trout and grayling in Montana, and I found both species in the same water, although I found the grayling more abundant in slow, sluggish parts of the stream where the water was shallower, even where the water must have been higher in temperature, and where I would receive no rise to my flies from the speckled trout.

The President: Do they take the fly well?

Mr. Willard: Indeed they do. I was so pleased with the grayling that I applied to the U. S. Commission and received a

consignment of eggs. We were successful in hatching about 25 per cent of the eggs, but our superintendent seemed to utterly fail in getting them to take any food whatever.

Mr. Dickerson: I remember seven years ago I stood in one spot and caught 47 grayling from one hole. The difference between the trout and grayling is, you catch four or five trout and they seem to put the others onto it and you can't catch any more, but the grayling will bite until the last one is caught.

Mr. Willard: In the Rocky Mountain streams it is generally the same.

**THE SPAWNING HABITS OF THE LAKE STURGEON.**

(Acipenser rubicundus.)

BY LIVINGSTON STONE, CAPE VINCENT, N. Y.

The first I knew about my being expected to present a paper this year to the Society on the subject of the "Spawning Habits of the Lake Sturgeon," was on seeing in a recent issue of "Forest and Stream" that I was billed to prepare such a paper for this meeting. If it were not for my having been put on the program I should not venture to offer anything on this subject unless it were under the title of "What Little I Know About the Spawning Habits of the Sturgeon."

As a correspondent wrote me recently, "the sturgeon is a strange fish." At least the Lake sturgeon, which is the subject of this paper, is a strange fish. It has a strangely shaped body, a strange head, strange mouth and skin, and a strange appearance generally; and one of the strangest things about the fish is that during the same week and on the same spot you can find female sturgeon with their eggs in almost every stage of development. This throws us all at sea as to their time of spawning, and we are not much better off in regard to their places for depositing their spawn, for if they ever have fixed spawning beds where they go regularly to deposit their eggs, I can only say that I never saw a fisherman yet who knew where those spawning beds were.

Another strange thing about the Lake sturgeon is that the fishermen never, or almost never, catch a spawning female in their nets with ripe eggs in her. They catch them when they are almost ready of spawn, and when they have just spawned, and also with eggs in them in all stages of development, but hardly ever with ripe eggs ready to be extruded.

The peculiarities of this strange fish have made it very diffi-

cult to gather information about their spawning habits and still more difficult to collect and impregnate their eggs.

The first instance that I know of sturgeon eggs being successfully taken and hatched, occurred in 1875, when Seth Green, assisted by, Mr. A. Marks, obtained from the fishermen who were fishing at North Hamburg on the Hudson, a ripe male and female, from which four pans of eggs were taken by the Caesarian operation of cutting the fish open. This occurred on the 7th day of June, about 10 a. m. On the 9th day of June, about 3 p. m. the first movement of the embryo was observed. On the 10th of June the eggs began to hatch, and by 5 o'clock the next morning, June 11th, all the eggs were hatched out. The temperature of the water during the period of hatching averaged about 70 degrees F.

In 1888, Professor Ryder, of the U. S. Fish Commission, made a very thorough study of the sturgeon at Delaware City, Delaware. (See the U. S. Fish Commission Bulletin for 1888), and in 1893 Dr. Bashford Dean made some interesting experiments, also at Delaware City, and since that time eggs have been frequently taken from sea-going sturgeon.

All the above experiments and studies have, however, been conducted with the salt water sturgeon (*Acipenser sturio*).

The Lake sturgeon (*Acipenser rubicundus*), is another fish, and, as far as I am aware, no extended observations in regard to this fish have been recorded, except those by Mr. William Lang in 1890, for the Ohio Fish Commission.

In the spring of 1899 I received permission from the United States Fish Commission to hunt for ripe sturgeon eggs on Lake Champlain. Two fishermen having located at Alburgh Springs, Vermont, for the purpose of catching sturgeon for the New York market, I arranged with them to have the privilege of examining all the sturgeon they caught before they were butchered; and for the time, established myself at Alburgh Springs with Mr. J. B. Lamkin and Mr. Myron Green for assistants.

On the 18th of May we overhauled our first batch of sturgeon, to the number of sixteen. Two females appeared to

be nearly ripe and we put them in our pens, hoping that their eggs might mature sufficiently in a few days to be taken and impregnated. Of the remainder, ten were males and four were females. These were then butchered by the fishermen. On opening the female fish, their eggs were found to be far advanced toward maturity, and it looked as if in a week or two at the latest we should strike fish with fully ripened eggs. In point of fact, unaccountable as it seems, we never caught any sturgeon the rest of the season that had any riper eggs than these had. It is needless to tell the story of our continued disappointments. The fishermen brought in plenty of fish, and allowed us the utmost freedom in examining them or penning them up, as we choose, but although we followed up the sturgeon until the latter part of June, examining them all and penning up what we thought to be nearly ripe, we never came across a single ripe fish or took a single egg. All that we examined were either spawned out or not ripe, and none of those that we confined in the pens seemed to make any progress toward maturity.

I will only state that the fish that we examined seemed to grow less mature, if anything, as the season advanced, and at all times the development of their eggs presented the most perplexing variety. By way of illustration, I will state the condition of the eggs of the female sturgeon that were killed by the fishermen and examined by us on several days. As I said above, the eggs of the fish that we examined on May 18th were in all stages of development. The same was true of those examined on May 25th—although on both days there were some that were very nearly ripe. On the 29th when we had expected to find fish about fully ripe, we examined in all, the eggs of four females. The eggs of the first fish were only half developed,—the second fish had just spawned,—the eggs of the third were just forming,—and the eggs of the fourth were about one-fourth developed. The same discouraging experience continued until the end, when after following the sturgeon thirty or forty miles southward from Alburgh, we abandoned this Will o' the Wisp chase and returned to Cape Vincent Station, it being then the last week in June.

This spring, 1900, I renewed the hunt for ripe sturgeon eggs, this time, however, not in the open waters of Lake Champlain but in the Missisquoi River, a tributary which empties into the lake in the extreme northwestern corner of Vermont. That sturgeon went up this river in the spring just after the run of pike was over, was well known, but whether they ascended the river to spawn, or to feed on the vast quantities of pike eggs and sucker eggs that had been deposited up toward Swanton dam, was not so definitely settled.

There being no funds of the United States Fish Commission to spare this year, for the purpose, no systematic attempt could be made to find ripe sturgeon, but through the obligingness of the river fishermen, and the help of Mr. Myron Green, we were enabled by persevering effort to score some successes and to make a few valuable discoveries.

While the sturgeon were running, there were two gangs of sturgeon fishermen on the river besides those fishing at Swanton dam. We prevailed on these fishermen—I do not know how, and it is a surprise to me yet, for they never had any pay for it—to hold the fish they caught until we could examine them, and also to keep in confinement any that we thought were nearly ripe. In this way we obtained an opportunity to examine over a hundred sturgeon.

Without going into tedious details more than is necessary, I will state as simply as possible the results of our observations, and they are as follows:

(1) The sturgeon do go up the Missisquoi River to *spawn*. This was proved by the fact that the fish going up the river, all had eggs in them of about the same degree of ripeness. Some had eggs that were fully ripe, while all that were caught going down the river had spawned out.

(2) The sturgeon spawn on the rapids below Swanton dam, for they were caught here fully ripe. Mr. Myron Green, who is a very careful and correct observer, thinks that they lie in the deep water below the rapids until they are ready to deposit their eggs, and then ascend to the rapids to spawn. This corre-

sponds to a considerable degree with what has been observed of the spawning habits of the pike perch.

(3) The sturgeon spawning season on the Missisquoi River is very short, and when the spawning is over the fish all go down the river with a rush, and though there may be hundreds in the river one day, in forty-eight hours after there may not be one left in the river. The rush down stream this year was on the nights of the 27th and 28th of May. They began to go up the river about the 20th, although there were sturgeon at the mouth of the Missisquoi River perhaps as early as the first week in May. The sturgeon spawning season on the river this year was, therefore, the week between the 20th and 27th of May.

(4) The sturgeon does not always deposit all her eggs at one time. A female fish whose eggs were so ripe and loose that they came from her without pressure, was found on being killed and examined, to have at least two-thirds of her ovaries filled with immature eggs.

(5) When the female sturgeon is ripe, her abdomen sags when the fish is lifted by the tail, as in the case with ripe salmon. Hence, there is no difficulty in distinguishing a ripe female. Her eggs also flow from her very easily, so easily, in fact, that the difficulty with a ripe fish in artificial spawning is, not to get the eggs out, but to keep them in.

(6) The mystery of the fishermen never catching a ripe fish in their gill nets is solved. It has been unquestionably a mystery why female sturgeon were caught with eggs in every possible stage of unripeness, but never with eggs entirely ripe. It is a mystery no longer, however. The secret of it all is that when the female is ripe the eggs flow from her so easily that when entangled in a net she throws out all her ripe eggs in her struggle to escape, so that when the fisherman takes her out of the net he finds only a spent fish. Mr. Green says that they throw their ripe eggs so readily that even in taking a ripe female ashore from the pens, she would be likely to throw her eggs before she could be quieted enough to be stripped.

Now that this explanation of what has seemed so mysterious,



has been discovered, it appears so simple that the wonder is that no one has thought of it before. Very likely this has occurred to many of you who are here present, but I can truly say that I have never found a fisherman yet, who knew the true reason of his not catching ripe female sturgeon, or one who ever even hinted at it.

(7) We succeeded in actually taking and impregnating a few sturgeon eggs. We found them to be glutinous like pike perch eggs and requiring the same treatment in handling and impregnating.

The eggs are about one-eighth of an inch in diameter, and can be readily hatched in the same jars that are used for hatching whitefish and pike perch eggs, and in the same way. There is this difference, however, between the eggs of the pike perch and those of the sturgeon, that the shell of the pike perch egg is very hard comparatively, and the shell of the sturgeon egg is thin and soft.

Some of the sturgeon fry hatched at the United States Hatchery on the Missisquoi River this spring were brought safely to Cape Vincent Station—the first lake sturgeon fry, I think, that were ever hatched under the auspices of the United States Fish Commission.

As to the question whether sturgeon eggs can be taken, impregnated and hatched artificially, I should say that great pains must be taken to capture them properly and to confine them properly. In fact, the preparation for this part of the work must be very elaborate. If this is not done, lake sturgeon hatching will be a failure, but if proper attention is given to these points, I am convinced that lake sturgeon hatching will be a success, at least wherever the parent fish can be found restricted in their movements to a small area, as, for instance, the Missisquoi River.

Allow me to add in closing, that for most of the information acquired this spring in regard to the sturgeon, I am indebted to the persevering efforts and keen observation of Mr. Myron Green, and to the accommodating and liberal spirit of the river fishermen, without which we should have accomplished nothing.

## DISCUSSION OF PAPER OF MR. STONE.

The President: I will say in connection with this that for years it has been the custom of fishermen to spear the sturgeon on the Missisquoi River at Swanton just below a bridge. They have their spear attached to a cord and will throw it from the bridge above, some 20 or 30 feet, striking a sturgeon and hauling it in over the bridge, and the eggs coming from the sturgeon so freely that they covered the bridge. The authorities were compelled to stop the fishing in this way because the bridge was smeared with sturgeon eggs. It was the main passageway in the village and they actually stopped the sturgeon fishing because they wanted to avoid the stench from the eggs. We have never realized they were a valuable fish, and the fishermen using seines on the lake for pike do not want to protect them because the large fish weighing 150 pounds or so will break their seines. The last Legislature passed an act allowing them to take sturgeon with gill nets.

I received about the time this sturgeon work was being carried on, a photograph from Mr. Green, who did this work, and he had two sturgeon placed in one of their jackets for stripping. The one cut open is merely to show the spawn; this will give you a view of the lake sturgeon. The fishermen sell the spawn for about 75 cents a pound.

Mr. Nevin: I would say, Mr. President, that at Lake Winnebago the sturgeon came in a great big school last year about the fore part of June, two or three thousand of them, and deposited their eggs, making the water appear a milky white. This year I laid for them about the 10th of June at the same point, but no fish showed up there.

Mr. Dickerson: Isn't there a difference between the sturgeon you spoke of as being caught on the rocks and our sturgeon?

The President: I suppose there is; yours are the lake sturgeon.

Mr. Dickerson: Not more than twenty years ago the Indians used to come into Detroit with wagon loads of sturgeon,

piled on like cord-wood, and you could buy them for from 50 cents to a dollar apiece. The Indians caught them by running a line between two stakes, attaching to this line a number of smaller lines reaching to the bottom and provided with hooks, and the sturgeon, while rolling on the bottom, were caught on these hooks. The Indians sold them about as cheap as you could buy wood. I have seen them sold as low as 50 cents apiece, but to-day they are the most valuable fish we have.

Mr. Clark: I wish to correct a statement that Mr. Stone makes. He says this is the only record of the United States Fish Commission doing anything with the sturgeon. Mr. Ravenel, I think, will recall the experiments that were conducted in the '80's or early '90's, on the Detroit River, by the United States Fish Commission. The results of the experiments we conducted at that time are on file at the Washington office. Although our success was not marked, we succeeded in getting sturgeon eggs and in hatching the fry. The eggs were taken also from the Detroit River to the Northville Hatchery and hatched, and we undertook to raise them, but were not successful.

Mr. Ravenel: Mr. Clark is, of course, strictly correct in his statement. In addition to that, sturgeon eggs were taken and hatched by Prof. Jno. A. Ryder and Bashford Dean at Delaware City, Del.

The President: That is a salt water fish.

Mr. Ravenel: All of the work with the sturgeon has been on a very small scale. There is no subject in fish culture, excepting the lobster, that we have given more time and thought to in the last few years. The sturgeon fisheries, from being very important on the Atlantic coast and Great Lakes, have dwindled to practically nothing. Two years ago, after a personal investigation on the Delaware River, we established a station at Delaware City, where about 500 nets are fished over an area of 50 square miles. At that time there were several thousand sturgeon caught, the eggs of one of which brought \$84, to give you an idea of their value. We found spawners or spent fish but once or twice in the entire time. I only hope Mr. Stone's pre-

dictions will be verified, but I must confess to being skeptical. If it is true that they discharge their eggs because they are held in the nets, that makes the work simple, but if that is true, why do not the fishermen catch hundreds of spent fish. I think that the fishermen capture possibly a dozen or two spent fish near Delaware City in an entire season, where there are not less than a thousand nets; possibly that is an exaggeration—I will say five hundred nets, but more sturgeon are caught there than anywhere else in the country.

As far as hatching the eggs of the sturgeon is concerned, we need not worry about that. We can hatch the eggs of any fish just as we hatch the eggs of the grayling or trout, in jars and on trays. If we can find a place where sturgeon spawn, we will guarantee next year to go there and propagate them. We are prepared to do more for the sturgeon than anything else except the lobster, but this spring we were unable to provide money for the work.

Mr. Dickerson: Have you ever made any effort at Lake Erie?

Mr. Ravenel: No. Dr. Henshall, I think, experimented on some river in Ohio and he found but one ripe fish; that has been about the experience of everyone. Unfortunately for us the fishermen have begun to use the ripe spawn for caviare.

Mr. Clark: I would say that our work was on two lines—one to find ripe sturgeon when caught, and the other to try penning them, as with the whitefish. We only found what might be called spent fish; that is, we would get a few eggs from each, I can't tell the number, but the penning of the sturgeon in any plan that we pursued was not a success.

Mr. Ravenel: There is no difficulty in penning the sturgeon; the trouble is in getting them so nearly ripe that we can afford to hold them. We have held them for months, but got no results. The sturgeon is the easiest fish to hold in the world; they tie a rope to their snout and hitch them to anything.

Mr. Clark: The trouble is in holding them and have the spawn develop. They will hold their eggs until doomsday, I guess.

Mr. Ravenel: In other words, to have the sturgeon when ripe.

The President: I don't understand why Mr. Stone didn't get more sturgeon on the lake. I will tell you why he made the failure last year, was that he didn't go to the river until the sturgeon had gone up and come back. The first he got word of it the sturgeon were returning from the Missiquoi river. They go up this same river every year to spawn.

Mr. Ravenel: Those that he caught had spawned.

The President: Well, they had some spawn in them, but my inference is that those fish had deposited most of their spawn and gone back. We can name you within two weeks of the time that the sturgeon will go into the Missiquoi river; also the Winooski river, flowing into Lake Champlain. There won't be many of them but will weigh from 50 to 200 pounds.

The Secretary: I think one reason why they thought some of those fish were spent is, that sturgeon probably spawn but once in two years. I am satisfied that some of the rainbow trout at our Paris station spawn but once in two years, and the Atlantic salmon are said to spawn only once in two years. Last year a scientist from the University of Michigan made some experiments with sturgeon on the south side of Lake St. Clair, near the head of the Detroit river. He was there for weeks, but had little or no success in taking eggs and fertilizing them; and while he did not come out and say that they spawned but once in two years, he intimated to me that this was quite possible, if not probable.

In 1893, the Michigan Fish Commission hatched upwards of 400,000 sturgeon, and in 1894 over 100,000. One of the difficulties we met was that the sexes did not run together to any extent; the catch at any given time was either nearly all males or nearly all females. At one point on the river a seine fishery was run by private parties, who held the sturgeon in crates for a day or two—none longer than two days. I distinctly remember on one occasion of a number of ripe females being taken from the crates, the spawn running out freely as the fish were dragged along over the dock, but there wasn't a single male on hand to fertilize them with.

Mr. Ravenel: I rise to ask why you say the rainbow trout only spawns once in two years? At our Wytheville station we have one that has spawned nine successive seasons. We have a record of the fish, its weight and the number of eggs, and I wish to say that our rainbow trout spawn every year.

The Secretary: I do not claim that it is a general rule for rainbows to spawn only once in two years, but our foreman at Paris states positively that some of our rainbows that have spawned before did not mature any spawn this year.

## THE SPAWNING HABITS OF THE LARGE-MOUTH BLACK BASS IN THE SOUTH.

BY J. BAYARD LAMKIN, BULLOCHVILLE, GA.

Under direction of Mr. J. J. Stranahan, Superintendent of Cold Springs, Ga., U. S. Fish Commission Station, we have made numerous observations and experiments, pertaining to the eggs and culture of the large-mouth black bass, some of which have proven very satisfactory and beneficial.

Throughout the whole spawning season, with but very few exceptions, we have been favored by clear water, which has enabled us to make more thorough observations than is possible in waters usually inhabited by the large-mouth black bass. The bass commenced to clear the gravel nests about the 1st of April, when the water in the ponds was 56° F., mean temperature. New beds were noticed each day, but no indications of spawning were noted until the 9th of April, when the temperature of the ponds had risen to 66 degrees. In the afternoon of the 9th, two bass were noticed on a nest, but it is not definitely known when the spawning was done, as a heavy rain on the 10th and 11th roiled the ponds to such an extent that observations could not be made until the 13th, when eggs were noticed on two nests. On the following day these eggs had, to all appearances, disappeared. New nests were discovered almost daily and the eggs disappeared, as the others, in from two to three days. On the 22nd of April, young fish were seen on and over the first two nests, which were first seen on the 13th, when the temperature was 61 degrees. These eggs were undoubtedly hatched on the night of the 13th, or the morning of the 14th, as will be shown later. It continued the same with all nests, that the eggs would disappear in two or three days and the fry show up in from six to eight days thereafter, depending altogether on the temperature of the water, and, I think, the amount of sunlight has something to do with the time.

Repeated experiments were made to test the period of incubation and raising of the fry from the nest, which all proved, without the shadow of a doubt, that the eggs hatch in from 48 to 72 hours after they are deposited, and that the fry raise from the nest in from six to eight days after they are hatched. These experiments were made by removing a few of the eggs from a nest with a rubber tube and placing them in a tin-pan or pail. The vessel containing the eggs was kept in fresh water at the head of one of the ponds, where it was deep enough to allow the current to circulate over it. At the same time that the eggs disappeared in the ponds it was noticed that the ones in the pans would be hatched, though it was very difficult to see them, even in the pans, without careful inspection, as they are almost, if not entirely, without color. To prove this more thoroughly, a rubber tube was placed in the nest, from which the eggs were taken to make the experiment, and fry were sucked up from the bottom, where none could be seen with the naked eye. The fry were apparently of the same age as the ones in the pan, as was indicated by an examination under the microscope.

A fact which surprised us more than anything else is that the bass spawn several times during the season. We observed early in the season that we had more nests with eggs on them than we had both male and female bass, and by the 15th of July the number had increased to about twice that. In all the ponds we only had 28 adult fish, while up to this time we have seen eggs on 57 nests, and the fish are still spawning. We know absolutely that one large male bass fathered eight different nests of eggs from April 9th to July 4th. He was the largest male bass we had and was marked by a couple of splits in his tail, which enabled us to identify him readily. On one occasion he was seen taking care of a large brood of fry and a nest of eggs at the same time.

We noticed that the principal time of spawning is in the afternoon, usually, we think, with a low barometer, as they spawned, almost invariably, just before a thunder shower. On several occasions a male was seen to have two females on the nest with him at the same time, and, as a rule, this proved disastrous to the eggs.



They were always more or less scattered about, sometimes covering several square feet of bottom.

It was soon noticed by Mr. Stranahan that the bass liked the roots of plants, or some sort of fibre, to spawn on much better than the gravel or natural bottom. A number of artificial nests, composed of cement, in the shape of a dinner plate or saucer about 16 inches in diameter, and covered with a thin layer of Spanish moss, the moss pressed into the bottom of the nest while in a plastic state, were made and placed in the ponds. The bass always selected these in preference to the gravel beds, or natural bottom. It was demonstrated, too, that these artificial nests are better for the bass to deposit their eggs on, for three reasons, as follows:

(1) The fibre affords more surface to the square inch than gravel or clay.

(2) It holds the eggs more securely.

(3) The eggs are freer from sediment than they would be on gravel or clay.

The plan of removing the eggs or fry from one pond to another by means of the artificial nest has not been thoroughly settled, but we feel satisfied that if so desired the fry can be removed after hatching much more easily than would be possible from a gravel or clay nest. In fact, it would not be necessary to wait for the eggs to hatch during good weather, when the ponds are clear. However, if the conditions are not just right, it is best to leave the eggs with the parent fish until after they are hatched, when the fry can be removed by simply lifting the nest from one pond and placing it in another. This prevents the necessity of netting very young fry.

It is much better not to have the fibre very thick on the artificial nests—merely enough to hold the eggs and not entangle the fry is all that is necessary. There is no question about the bass preferring the fibre to gravel or clay. On one occasion we placed an artificial nest in one of the ponds at 2:00 o'clock p. m. and at 2:05 a male bass was on it cleaning it off, although there were a number of gravel and clay beds in the pond.

## DISCUSSION OF MR. LAMKIN'S PAPER.

The Secretary: Mr. President, I want to say that the experience they had at this station, regarding the character of the spawning beds selected, corresponds practically with our experience this spring. We have one pond for big mouth bass, and a portion of it is weedy and grassy and in another portion we placed artificial nests with a gravel bottom. The big mouth bass would not spawn on the gravel-bottom nests nor work on them, spawning only in weedy or rooty places.

The President: I will say in connection with the bass in Lake Champlain that the large mouth bass selects the reedy and swampy land for spawning. They select the rivers for the purpose of spawning also, and the small mouth bass select the gravel beds, very similar to the trout.

Mr. Thompson: I wish to say that at the United States Fish Commission station, Manchester, Iowa, the large mouth bass don't select gravel or even clay. We built a few artificial nests in the pond but none of them were occupied. They were placed about ten feet away from the shore. Those bass came up practically right on shore, and spawned under the overhanging grass, which protected them; they selected the soft, muddy bottom, where there was aquatic growth to hide them from observation.

The Secretary: Mr. Lamkin's experience seems to differ from ours in one respect. He speaks of one male having two females on a nest at the same time. It is a very common thing for several male bass to be after one female, but the competition for favors seems to be between the males exclusively; the reverse of that we have never seen.

Mr. Ravenel: The spawning of the bass on gravel, or mud, or clay, is something that has attracted attention at the various stations, and it seems to be largely a question of locality. In Missouri the large mouth bass invariably spawn on gravel; in the Mississippi River Valley they are utterly indifferent to gravel, they go on the mud or clay; in Texas we put gravel in the ponds and in no case did they accept it, but deposited their eggs on the

bottom of the pond. In Georgia, where the opportunities for observation are exceptionally fine, the water being clear and the growth not sufficient to obstruct the vision, they spawn on the bare earth, and this year Mr. Stranahan found that these artificial nests were acceptable. With the small mouth bass we have had little or no experience. If anyone can give us any information on raising black bass we would like to have them do so. People ask for a million bass when there are not a million raised artificially in the country.

The President: Do you raise your bass to fingerlings?

Mr. Ravenel: Always.

The President: How many do you raise?

Mr. Ravenel: 250,000 to 300,000.

The President: Do you estimate them?

Mr. Ravenel: Never, all distributions are made by measurement or by actual count.

The President: Any further discussion about the bass?

Mr. Thompson: I would like to ask Mr. Ravenel what has been the percentage of rearing of those that have been put in the troughs?

Mr. Ravenel: In some cases we have had splendid results. We have raised 12,000 out of 15,000. Of course trough raising of bass amounts to very little. We raise them in nursery ponds. Mr. Leary conducted a number of experiments in which he showed very conclusively that it is better not to move the bass too soon from the rearing ponds; it is better to wait until they become an inch long anyway.

The President: I would like to ask Mr. Ravenel if he has ever had any experience in determining the relative growth of the big mouth bass and small mouth bass?

Mr. Ravenel: Yes, in Washington, and there was very little difference up to October. We raised a large number of the big mouth.

Mr. Thompson: I would say that I placed a few large mouth bass in a pond in which there were no other fish except

pumpkinseeds, as we call them, and in 15 months I caught come of those bass and they weighed a pound apiece.

Mr. Ravenel: That is not surprising, the large mouth bass are rapid growers.

The President: How much do you say?

Mr. Thompson: They weighed a good solid pound.

Mr. Ravenel: In Texas the bass spawn in the fore part of March, and we commence the distribution in April, and before we get through distributing in June we are delivering fish that are 3 or 4 inches long.

Mr. Hurlburt: Two years ago, Mr. Ravenel, you sent me a can of 500 small mouth black bass and they were all sizes.

Mr. Ravenel: That is so.

The President: I will inquire of Mr. Ravenel if he has had as much success in propagating the small mouth bass as the large mouth?

Mr. Ravenel: The big mouth bass are better adapted to pond culture than the small mouth. The Potomac River, from which we get our water supply, is one of the best bass streams in the United States, and in the last 10 years we have introduced the large mouths so that they range over about 60 miles of the river.

The Secretary: I hardly agree with Mr. Ravenel, when he says that the big mouth bass are better adapted to pond culture than the small mouth bass.

Mr. Ravenel: I should have qualified that as to the Great Lake section.

The Secretary: We have about 300 stock fish in our breeding ponds and each pond is provided with gravel nests. At the first spawning there were 50 nests occupied; out of those 50, 44 were good and the others were worthless. From those 44 nests we took something over a quarter of a million fry. Heretofore we have fed the fish on liver and they didn't take very kindly to it, the result being that at spawning time the fish were ravenous and hungry, and the others fought and drove them away and destroyed the eggs, and even where they spawned un-

molested the eggs were blighted. Our foreman, Mr. Lydell, began last year feeding the fish on minnows, and gave them all they would eat, and gave them all they wanted again this spring, and as a result when they began to spawn this year there was no fighting; they paired off and spawned unmolested, and as a consequence 44 out of 50 beds were productive, and we think that is the secret—they must be fed on fish food.

The President: How large are your stock ponds?

The Secretary: Well, some are irregular in size, but those of a regular size are about 80 feet long and 40 feet wide.

The President: How deep?

The Secretary: About five feet in the center. We place the spawning boxes in 18 inches of water.

The President: How many bass in that space?

The Secretary: Different numbers, from 30 to 50.

The President: You mean about 20 females?

The Secretary: Yes, we generally divide them up as nearly equal as we can.

Mr. Ravenel: Our methods are practically the same, we never feed on liver, always on chopped fish or live fish.

To refer again to the despised carp, the solution of raising bass food is the carp. We feed our bass every spring from 500,000 to a million young carp.

We have never had any trouble in the bass occupying the same nests. The spawning area of the pond is divided off into departments, and a dozen pair of bass are put in each department. I want to ask Mr. Bower how he arrived at that estimate of a quarter of a million bass fry?

The Secretary: We allow the male fish to guard the nest until after the fish have hatched, and just a day or two before the fry are ready to rise we set a screen around each bed—we call it a fry retainer—it is a band-iron frame covered with cheese cloth. In a few days, depending on the temperature of the water, the fry will rise; we then take them out and count a part of the product of each bed, enough so we know our estimates are very close. We have taken as high as 10,000 from a single bed,

and as low as 2,000 or 3,000. But it is just as easy to arrive at the number, approximately, as it is of trout or any other fish that are estimated from a partial actual count. I don't know of any better way than that, unless you count them all. We have very little guess work about it; we know positively that our estimate is very nearly correct, as nearly so as any careful estimate can be.

Mr. Clark: Mr. President, I didn't propose to take any part in the bass discussion, but Mr. Bower made one statement that I want to correct a little. He says, it is just as easy to arrive at the number of bass as it is of trout or whitefish. Now, with the trout we have a chance to handle the eggs and know exactly just how many eggs we have just previous to hatching; that is something you cannot do with the bass. Now, if we have a box of 60,000 trout eggs, we know that usually we are going to have 58,000 fry anyway.

The Secretary: That is all very true, I will admit that, but Mr. Clark will agree with me, I think, that there is far more guess work telling the number of whitefish after they are hatched than there is with bass. Now, we hatch quite a number of bass, and while it isn't practical to count them all, we count a sufficient number so that we know our figures are very nearly correct.

The President: Any more remarks on the bass? If not, I would like to tell you our experience in Vermont. A number of years ago, perhaps fifteen, a bass fad swept through New England. The State Commissioners up there and the United States Commission both had the small mouth bass and put them into every pond they could find; they put them into our trout ponds and into our large and small ponds. When they were put into the small ponds they would clean out the perch and bullheads. I have one pond in mind of about fifteen acres that was full of bullheads or hornpouts and perch, and the bass were introduced there and they cleaned out every fish in that pond. To-day the bass seem to thrive there to a certain extent, that is, propagate there very rapidly. We use that pond as a source of supply for

supplying others. We seine that lake every year and take out bass running from three inches in length to a pound in weight, and that is the only place where we do any work in introducing them to other waters, but if we could go back fifteen years we would not let a bass come into the State. Our waters were originally all trout waters. In Lake Champlain we want all the bass we can get, but many of our lakes have been ruined by the bass. In those lakes they won't bite, they won't take our bait. There are ponds where we know these bass weigh six or eight pounds and we cannot induce them to take any bait at any season of the year.

The Secretary: I entirely agree with Mr. Titcomb that black bass should never be introduced in any water containing salmon or brook trout or any fish of that grade. Some years ago I was stationed at Green Lake, Maine. Not long before that someone had put a supply of small-mouth bass in that lake and they were becoming quite numerous, although the lake was already well stocked with landlocked salmon. The residents there were as much opposed to the bass as some localities are to the carp.

Another point I want to speak of. Someone spoke about food for the fish in the ponds. Now, in addition to the minnows that we supply them with, we also hatch a great many suckers; all the ponds are simply alive with sucker fry. We also introduce what is known as the corixa, the young corixa making splendid food for the young bass. We allow the center of the pond to become filled with vegetation and the water to get pretty warm so there will be plenty of animalcula for the fry to feed upon. In this way, of course, considerable food for the old and young is provided, besides that brought in from outside sources. I believe, as Mr. Ravenel says, the solution of supplying food for the bass is in the breeding of carp expressly for food.

The President: Any other remarks on the bass.

Dr. James: If it would be in order for me to make a remark on the carp just here—I take more or less interest in that subject—I want to say that I don't want to be too hard on that kind

of fish. I believe the whole trouble is in the manner in which it is cooked and prepared for the table. I think that the carp received a "black eye," as we say, simply because the people did not know how to prepare it, and I believe that the New Yorkers get a little ahead of us Philadelphians in cooking this fish, and that the reason we do not like the carp may be because we do not know how to cook it, for now we find it at many places; as soon as they find out how to cook it they all want the carp. Then there is another thing; I see here by our debate that the carp is a good food for other fish, that the spawn is good for other fish to feed upon, and if it has no other use I am going to thank the United States Commission for introducing the carp. I am in favor of the carp at the present time.



**BROOK TROUT FRY; A RESUME OF METHODS.**

---

W. T. THOMPSON, NASHUA, N. H.

Much has been said regarding the hatching and care of brook trout fry, and so well said; hence it is not with the expectation of advancing any strikingly new thoughts that this paper is presented, but rather with the view of promoting discussion and thus incidentally securing for the benefit of the individual the accumulated and composite experience of the entire membership of this society. A re-threshing of the old straw may still bring to light some few golden grains hitherto overlooked. I do not anticipate that my ideas will meet with your unanimous approval. Indeed, should they not be criticised and better methods suggested, I should fail of accomplishing my purpose, namely, exchange of experiences—not successes alone, but failures as well, with the reasons therefor. Along this rock-bound, storm-swept, dangerous New England coast, a wise government has, in addition to charting the seas, placed buoys and light-houses to mark what? The smooth sailing? No, rather the rocks and reefs on which many a good ship has been wrecked. Is it not the duty of this Society to so chart the fish-cultural sea, mark the rocks where lay danger, help others to avoid them and sail safely into the harbor of success?

I take it that each of you has had a greater or lesser experience along this line, many of you were amongst the pioneers, so I shall endeavor throughout to make my remarks suggestive rather than exhaustive.

Pond and lake, brook and river, spring and driven well have each, in different localities, served well the fish-culturist's purpose. As to temperature, 35 to 55 or even 60 has answered, the mean and not the extreme is advocated. In the north it should be low enough to so retard development that food will be abundant in the waters by the time the fast crowding quarters make

planting a necessity. For ease of manipulation, freedom from the trouble and worry of snow and ice, leaves and freshets, with soil and debris laden waters, the interminable work with screens, the danger of washouts and the various other unenumerated hindrances; give me, if you please, spring water or water from a driven well, temperature 45 to 50, sufficient fall for aeration and yet with troughs at comfortable working height.

The spawn, shall it be from wild or domesticated fish? I believe it cannot be gainsaid that eggs from the latter—at their best—with proper and sufficient food, good range and a moderately cool temperature, are larger and produce larger fry, which, with an inheritance one generation, at least, removed from the wild state, are more easily handled and more susceptible to the enforced artificial conditions awaiting them in their life of captivity. On the other hand, and may I not say, in the majority of cases, improper feeding, either a lack or an excess as to quantity, insufficient as to variety, and, as we all know, during the hot summer months at least, too often most offensively deficient as to quality; the lack of exercise owing to restricted range and being freed from the necessity of “hustling” for a living, all conspire to sap the constitution of the parent and tend to produce fry with but little inherent vigor and vitality, and especially so when coupled with generations of inbreeding. Under the usual conditions incident to captivity, I believe I am perfectly justified in stating that the consensus of opinion is largely in favor of spawn from wild fish as being more uniformly satisfactory.

Thorough and continuous aeration is the great essential in hatching. A given quantity of water flowing in to a trough will renew itself twice as frequently when kept at a depth of three inches than if kept at six inches, so we drop in our trough a three-inch galvanized dam for the present. The tail screen is the greatest death trap ever placed in a trough, but we cannot do without it; let us lessen its murderous suction power by extending the distance from the Niagara of the dam; make it, say, four inches at least. Much has been said of the additional aeration

secured by the use of the horizontal screen. Possibly the simple wooden frame wire hatching tray is the form most generally used. We wish to extract the life-giving virtue from all the water, and not of one strata only, so we peg our tray in position at the greatest angle possible while still retaining the current both above and below it.

Many of the nearly hatched embryo have their vitality so weakened by the diversion or impeding of the free flow of the current caused by the settling of the shells on them that they die "aborning," or at least before the sac is absorbed.

Clogged screens at any time, and more especially during the hatching period and early life of the fry, is wilful fish slaughter. Absolute cleanliness should be the motto at all times.

In theory, we have a free and equal flow of water throughout the entire trough. How is it in practice? In your daily round, have you not some morning found glazed eyes where but yesterday all was well? It may be a little group here and there, or it may be a streak running from one end of the tray to the other. Theory will not give them back life. Investigation may or may not fix the cause. Why do so many embryo fail to break their shells? They were apparently strong and well developed up to or almost to the hatching period. There they are, there they remain. Living or dead, which? It is possible a few may still have sufficient vitality to break forth into a brief weak and stunted existence; but is it not a fact that there remains on the trays at the close of the proper hatching period, in almost every lot, an uncomfortably large number of eggs of this description? If this is a fact, why? Can it not be overcome? The cause, I firmly believe to be deficient, or, rather, imperfect aeration arising through some diversion or obstruction of the current. Theory and fact have conflicted ere this. You may amuse yourself with theory if so disposed, but facts such as these are too uncomfortably assertive for any such pastime. The cure, more perfect apparatus, giving more thorough, perfect and reliable current, better aeration; result, stronger fry and more of them. From personal experience at the Nashua Station, the salmon basket of the Pacific coast, somewhat modified as to size, would

seem to be the coming device. Have you tried it? No? Do not fail to do so this fall. Old troughs can easily be equipped for the purpose. With three gallons of water, temperature 48 degrees, we hatched 25,000 eggs in a single basket one foot square with infinitely better results than we secured on trays 1x2 feet, carrying only one-third the number of eggs per tray. Hatching capacity is marvelously increased.

Next we turn our attention to the avoidance of the danger of suffocation during the sac stage. Fry will pile up on each other. If we are carrying them in large numbers, three or four subdivisions of the trough by the use of perforated zincs will be of material assistance. Right here let me mention a weakness of the ordinary trough that is not obviated by the use of the horizontal screen. Our restless little friends will persist in scrambling to the head of the trough, gather in dangerous numbers in the eddies in the corners back of where the supply falls; if you are not on your guard, some day you may be surprised to find a few thousand ashy-gray corpses floating around. A perpendicular screen near the head of the trough just below the inflow will keep them from this danger. During this stage the fry remain on the bottom, drawing only from the lower strata of water. Are you still crowded for room? Do you wish to double your carrying capacity? Then use a retaining, or fry basket, in each subdivision; it works somewhat on the same principle as the double-decked hog and sheep-shipping cars we are familiar with. Thus the problem is easily and safely solved. Using only three gallons of water per minute in a trough 12 feet long and 1 foot wide, subdivided by perforated zincs into four compartments, and using baskets in but two of the divisions, we successfully carried 65,000 fry to the feeding stage; in fact, actually taught them to feed. The wooden frame of the basket resting on the sides of the trough supports the bottom about one and one-half inches above the bottom of the trough. Had we used a basket in each compartment we could have increased the fry to 80,000. It is a fact that more fish can be carried in the baskets than in the trough proper, since the bottom fish in the former cannot have their air shut off by those above. This and the hatching basket, as adapted to trout work,

are the result of the lifelong experience of Supt. Waldo F. Hubbard, of the U. S. F. C., with the Pacific salmon.

Who knows the cause of the ever-present blue sac? Have you a theory?

Remember, that all fry are restless, inquisitive little beings, poking their noses in wherever they find a hole sufficiently large. Isn't it surprising how small that sufficiently large can be?

All our authorities seem to presuppose that the fry are free swimmers, "able to balance themselves easily and gracefully in the water," and ready to rise and strike at minute pieces of cork, or other floating substances, when ready for food. I wish to state most emphatically that such is not the case with brook trout fry.

On behalf of this Society, on behalf of my brother fish-culturists who may also be led astray by this false doctrine, on behalf of the neglected and suffering fry, I wish to build my lighthouse right here. I would build the foundation so broad as to entirely cover this rock of danger. I would have the light so bright and far-reaching as to shine out wherever a brook trout is propagated. You will kindly remember that I am not speaking now of trout in general, but the brook trout in particular. Much of the complaint of failure to get certain lots to feed, much of the thin snakelike appearance so often seen in the troughs in the early feeding period, and much of the death rate at this time, are directly traceable to too strict adherence to this teaching. Simply because the brook trout is generally known as a surface feeder, it is assumed that he must necessarily be such from the very beginning. I wish again to state most emphatically that while such may be the case frequently from necessity, by choice, or, to put it more correctly, by nature, brook trout fry are bottom feeders for a brief period at first—in other words, they feed before they can swim.

Let us consider the philosophy of the matter. The Creator packs a month's rations in the little fellows' knapsack, tells him he must forage on the country for subsistence hereafter. In the wild state do you suppose he waits until this supply is exhausted before making an effort to skirmish for himself? I ask you, is it a reasonable supposition that the change from absorption to feeding and

functional action of the organs is sudden and radical rather than slow and gradual? No progressive breeder in these modern days ever thinks of waiting till weaning time before accustoming his young stock to the change of food. The transition is made so gradual that the sensitive digestive organs do not resent it, the change from milk to grain is accomplished almost imperceptibly, not an ounce of flesh is lost, not for a day is the growth checked from infancy to maturity. This is the secret of the wonderful development of herds and flocks of to-day. It is true that in days gone by the farmer, in his wisdom, ran things differently. A direct transition from absorption to digestion is much more radical and dangerous than from milk to grain. Which are we, farmers or breeders?

Let us watch our newly-hatched fry. At first his only instinct is to hide, to burrow somewhere out of harm's way; nature's provision is all sufficient for the present. Some weeks have passed, say two-thirds to three-quarters gone, then we note a change. At nature's changing call, segregation begins, the older and stronger fish draw apart; they are no longer a component part of the burrowing mass, but take up an independent existence as individuals. Though unable to swim, our young alevin can and does move around on the bottom. Why? Knapsack getting light, he is now on the lookout for minute animalcule. Let us test the matter. We dip our feather in the food, specially prepared, infinitesimally fine, draw it lightly over the surface of the water, the minute particles sink very slowly, one inch, two inches, three inches, and still not a strike; as surface feeders they are evidently not ready. But wait a moment! Just watch that big fellow on the outer edge there. See the glitter of his eyes, his whole body seems tremulous with excitement. The particle slowly approaches, only an inch, only a half inch away. A whisk of the tail, a quick dart upward, and one little fellow has found what his nature craved, one fish has learned to eat. He settles back to the bottom; then, at the new and strange sensation as the food passes into the stomach, he leaps and darts about for a few seconds, seemingly in a very paroxysm of delight. That atom was the lever that threw into gear the whole machinery of digestion and assimilation. He has found

his vocation in life; he lives but to eat. From that moment he is as brave, as cruel and as daring a little pirate as ever sailed the waters. As bottom feeders, they *are* ready. Continue feeding not less than six times per day. Nature and example will soon teach the others. In three or four days, assuming the fry are of an age, they will be feeding quite generally; but the amount consumed per trough will be very small. Requisition is still being made on the knapsack. In a week's time, perhaps, a few of the stronger fish will begin to rise a little from the bottom; in two weeks all will be up—big, broad, lusty fellows as ever delighted the eye, the equal of fish a month older fed by the usual methods, much more even in appearance and with infinitely greater possibilities for future growth and early maturity. Feed them generously, overfeeding for fish under a year is but a bugaboo; feast your soul on his splendid growth, revel in anticipation of some brother angler's delight when, grown to a two-pounder, the little fellow we saw take his first bite shall strike his fly and give him the strongest, gamiest battle of his life.

Much of the food fed at this time is entirely too coarse for the fry's delicate digestive organs. We find that grinding it three times through a one-sixteenth inch plate and then running it through a wire screen 24 strands to the inch makes it very acceptable in size. A little of the food will, of course, sink to the bottom; feathering at this stage would be tedious as well as injurious. It is not necessary, however, until the fish rise. Take a fine mesh net, a little narrower than the trough, draw it along the surface of the water; the current will raise the food as well as some of the fry. The latter, being heavier, will soon sink; reverse your net and you will get most of the waste food. After a few attempts, you will soon become expert in this simple and harmless method of trough cleaning.

At the beginning of the feeding, take out the small dam in use heretofore and substitute one 4, 5 or 6 inches deep, as your trough may permit. It serves two purposes, additional range for the fast spreading and raising multitude and greater opportunity to secure the food while in suspension.



Two rather serious objections may still be urged against the horizontal screen, even in connection with the head screen. The stronger fry so crowd against it as to make it rather difficult to place feed before them; then there seems to be an eddy that collects and retains food and other filth which should be carried by the current in conjunction with the constant movement of the fish to the lower end of the trough. We have therefore abandoned it in favor of the head dam. Aeration seems improved. A delightful current is created thereby, which can be regulated by the height of the dam and volume of water. The little fellows thoroughly enjoy the pleasure of breasting it. A light wire of suitable height on top of the dam prevents their shooting the falls as they grow older.

Take special care of the weak, the strong will look out for themselves. Frequent thinning of the trough is necessary. The weaklings naturally gravitate to the lower end. Take them out of the various troughs and place them by themselves. Special care and extra feed will soon bring them out.

Occasionally, and without giving the matter due consideration, people characterize our great trout breeding establishments as mere toys, playthings for the benefit of the rich or idle, point to the unanswerable statistics of the marine, the salmon and Great Lakes hatcheries and ask triumphantly, where are yours? There are some things in this world whose value cannot be measured even in coin of the realm. The statistics of the brook trout are graven on the heart.

In the Koran there is a passage reading thus: "If a man have two loaves let him sell one and buy a lily; bread feedeth the body, but the lily is food for the soul." So it is. In pursuit of the brook trout, in wandering mid field and forest, by shady brook and rushing mountain torrent, in communion with nature in her wilder, grander moods, the weary souls of countless thousands have been refreshed and strengthened into truer, better and nobler lives.



DISCUSSION OF MR. THOMPSON'S PAPER.

Mr. Thompson: I might say that these zincs are not a fair sample; the regular zincs are perforated. In connection with the salmon hatching basket and the retaining basket, I might say that the Harrington & King Perforating Co., of Chicago, can make them entirely out of zinc. The price I believe is twelve cents a square foot.

Mr. Hurlbut: It would be a good deal of work to take care of a box fitted up that way.

Mr. Thompson: Oh, I don't know. You understand, Mr. Hurlbut, the use of these compartments is only during the sac stage. We carried 65,000 in a trough twelve feet long, and we could have raised the amount to 80,000 if we had had two more boxes in use.

Mr. Hurlbut: I was down to Cold Spring hatchery this spring and I saw something there I never saw before. I saw a trough full of fry, and on top of the water were a number of floating boxes, also filled with fry. The superintendent told me they had over six million brook trout fry in the hatchery, besides some thousands of lake trout fry. That was all very well for them but of no use to the commercial hatcheries.

Mr. Thompson: I believe I heard Mr. Handy remark that there was a great deal of trouble to keep the fry from suffocating; this will prevent that. I might say in further explanation, those that are suffocated are always underneath, the others crowding over them and shutting off all the water, but it doesn't matter how deep they crowd on this, the under ones are absolutely safe. You can carry more in your trough if you use these baskets, even if you don't use the bottom at all. In other words, you can carry more in your baskets than in your trough proper.

The President: You get a circulation underneath?

Mr. Thompson: Yes.

The President: I want to ask a few questions about this. I like this fixture for using the screen without a wooden frame around it, is there any objection to that?

Mr. Hurlbut: It is better this way than the old way. In

the end there, instead of using the dam across there, they use a tube with a rubber band around it. If you want it higher you raise it up; you can have it one inch deep or higher.

Mr. Ravenel: I would like to ask Mr. Clark how many fry he carries in relatively the same space?

Mr. Clark: I have been very much interested in Mr. Thompson's paper and of course have always been interested in those models that he has shown, but I hardly think he brings them forward as new inventions, do you Mr. Thompson?

Mr. Thompson: No.

Mr. Clark: They have been in use, all of the models, for quite a number of years and are all good. Of course his system there of slides is nothing but a remodification of the Clark-Williamson box, and of the Williamson box; we are using them right along, only instead of tin ours are wood, but the plan and the whole system are practically the same. The idea of forcing the current from underneath is all right. The current in the Clark box is downward while they are hatching the eggs, but after the eggs are hatched the box is turned around and then the current is upward. Our system, as perhaps a good many of you have read, is thoroughly described in the Manual of Fish Culture, and it tells there just the number of eggs we carry on a given number of trays. Each box or compartment in the Clark-Williamson hatching trough is 19 by 10 by 12 inches, and holds 60,000 lake trout eggs, 6,000 on each of the inclosed ten trays.

The President: Carry as fry?

Mr. Clark: Carry them forward to the point where the eggs are ready to hatch, then we reduce them to 40,000 and carry them in the same space until they are hatched and until the fry are ready for distribution or feeding. In other words, we leave from these 60,000 eggs 40,000 for hatching and rearing.

The President: And carry them until just before the sac is absorbed?

Mr. Clark: Until the sac is absorbed.

Mr. Handy: I would like to ask how much water you let through the trough?

Mr. Clark: It runs up to 12 gallons and down to between 6 and 7 gallons. Any reasonable amount will do the Clark box; it is a box within a box, and the water flowing in forms an eddy and passes down through the trays and escapes through the holes in the bottom of the inside box and comes up around the sides. Now, after the eggs hatch, the box is turned around and the current then flows up through these bottom holes. Understand, the oblong wire mesh is not used at the Northville station or an other station that I have connection with, for the reason that we always hold the fry on the same tray we hatch on; we don't allow them to pass through or over the tray, for we couldn't handle the quantity we do with such a process. The floor space where we handle from twelve to fifteen million does not occupy, with the alleys, over about 28 feet—that is the length of the troughs—by about 40 feet the other way. Of course, our methods are described more perfectly in the Manual. That gives you—I think in the article on lake trout, more particularly—a full description of every point in regard to the workings of our station.

Mr. Ravenel: I only called attention to that because Mr. Stone, of Cape Vincent, has built the same thing for the brook trout. I was there a few weeks ago and saw several stacks of trays taken out. The fry were in splendid condition, the sac just absorbed, and some were shipped the next day on trips of twelve hours with practically no loss. I have forgotten the exact number on the trays, but it was the first time I had seen brook trout handled in that way and with such splendid results.

Mr. Clark: I would say further, Mr. President, in regard to the trouble which Mr. Thompson speaks of, of quite a large quantity of eggs not hatching out at the end, that we have no such experience. The only trouble that we have, with lake trout especially, is the blue sac, and we do have quite a percentage of blue sacs, but no loss of eggs after they have been thoroughly sorted; we hatch after that approximately 100 per cent.

Mr. Hurlbut: What is the cause of the blue sac? (Laughter.)

Mr. Hubbard: I would like to say a few words in regard to the basket. In taking the dead eggs from the basket, the basket being filled about half full, you just lift it up and raise it in that manner, which gives a boiling motion to the eggs and allows the dead ones to be seen.

The President: You don't do that during the delicate stage of the eggs?

Mr. Hubbard: No. Now they are not a long time in the delicate stage and you can leave them all that time without picking out the dead ones.

Mr. Ravenel: How many days would it take to eye the eggs?

Mr. Hubbard: At a temperature of 38 it would take, well, two months at least.

Mr. Ravenel: On the Pacific Coast they cover up the eggs two to four days after they are taken and they do not uncover them until the delicate stage is passed; it may vary from 15 to 30 days. The eggs become covered with a sediment, but they wash them and have very little loss.

Mr. Hubbard: I don't see much difference between the salmon and trout eggs, as to one being more difficult to handle than the other.

Mr. Ravenel: I think experiments have shown that brook trout eggs will stand transportation better than salmon eggs.

Mr. Dinsmore: We have always eyed eggs in thirty days. My experience in eyeing eggs has been that there would be about 15 days, or perhaps 20, that I would consider them critical, injurious to handle. Now, if they are left a week before you pick them over, every bad egg that you touch would fall away. If they are left 20 days without being disturbed all the eggs underneath and over a bad egg form into a ball.

Mr. Thompson: In order to further discussion along that line I would like Mr. Hubbard to state the result of an experiment that he made out on the Pacific Coast regarding leaving salmon eggs in the baskets during that period.

Mr. Hubbard: This lot of salmon eggs was picked over

after they were taken and then put in a basket and covered up for 18 days with a board and left perfectly dark. When the board was removed the top of the eggs was covered with mud, you couldn't see an egg, but as the water came up through the basket the under side of the egg was perfectly clean, and by moving the basket up and down, the mud was washed off and the eggs would be picked over. The loss wasn't near as much as in other baskets, not near as much in this basket that was covered and not disturbed.

Mr. Dinsmore: Were any of those covered with fungus?

Mr. Hubbard: There were a few, but what few stuck to the fungus didn't amount to as much as in those that had not been covered up.

The President: Any further remarks on this subject?

Mr. Clark: You seem to touch upon the delicate stage of the eggs, but I don't hear anyone say when this stage is, and that ought to be answered in some way.

The President: I would say that we collect wild trout eggs and we don't want to handle them any more than necessary after the first day. We can, but don't want to.

Mr. Clark: Some experiments were made by myself, and days and dates were given, which are now in the hands of the United States Fish Commission, and the experiments were very thorough, and we found we could handle them any time up to the eighth day as safely as after they are eyed.

Mr. Thompson: At what temperature?

Mr. Clark: A temperature of 48. I never should hesitate to move green eggs any time up to that time, but between that and up to the sixteenth and eighteenth day, I never should move them.

Mr. O'Mally: Speaking of the delicate stage, I have had some experience the past year and I find that salmon that are handled after the eighth day don't do so well as those that are left alone after the fifth day. I picked one basket right through the whole season from start to finish, each day, and it survived, but those that I picked beyond the fifth day showed the effect of

handling. Our water at that time in September was about 50 degrees. We have a lot of mud in our troughs, too, because the supply of water comes from a creek, and the eggs were covered with mud at the time, that is, the top, so we couldn't tell what was in the basket. They were there fifteen days before you could see the spinal column. I would suggest if anyone was going to build a basket, that instead of making it with the wooden rim they use a number eight steel wire. I would like to ask Mr. Thompson how that basket is arranged, if it goes to the bottom of the trough?

Mr. Thompson: The basket is supported on the side of the trough, and you can regulate it, that is, you can make it any depth. Of course, you don't want it to rest on the bottom. You can have it an inch or more from the bottom, as you desire.

I was going to say in relation to Mr. O'Malley's remarks, the Harrington & King Co., of Chicago, can make them of zinc; there is no rust to the perforated zinc and I think it is no more expensive and probably more durable.

Mr. O'Malley: My idea of the steel rim for the basket was to do away with that wooden apparatus to keep the basket off the bottom of the trough. In the salmon trough we use four small pegs, one for each corner.

Mr. Thompson: On the baskets?

Mr. O'Malley: No, I mean the other little cleats up on the trough, and the basket rests on each corner.

Mr. Ravenel: On the side of the trough?

Mr. O'Malley: No, on the bottom.

The President: I want to discuss with Mr. Clark a little more about the handling of green eggs. I do not agree with him. I have handled trout spawn a number of years, and we used to transport the green spawn on a few hours' run the first or second day after they were stripped. Then we adopted the plan of setting up troughs at our field station. We set up a trough in a tent sometimes and eye our eggs there. In other cases we get hold of a deserted farm house, or put up a little shanty, in one of which I eyed last fall 600,000 eggs before I took them to the hatchery at all, and we found we could get a much larger per-

centage of eyed eggs, if we took them and laid them right down in troughs in the woods and let the water flow over them there until after the eye spots have shown plainly through the shell.

Mr. Nevin: We never intend to take them out of the trough before ten days; after the tenth day we take them out but never attempt to before that.

Mr. Clark: As I am on record in an official way I cannot go back on it, and I still stick to it because I tried the experiments myself. The time and everything was accurately noted, and I was surprised at the results of some of the experiments myself. I didn't think it would be necessary to hold eggs between those times, but I wouldn't to-day any more think of having eggs turned out of the trough between the tenth to eighteenth days than I would fly. But, Mr. President, we give our experiences here, and I do this way and you that, and we have good results. Now, we are not supposed to stand up here and say we have had those results unless it is so, but what proves to be the best way in one case may not do in another.

**PROPAGATION OF THE PACIFIC SALMON.**

---

BY S. W. DOWNING, PUT-IN-BAY, OHIO.

Were I writing this article solely for the purpose of reading before this meeting, I would not presume to go into details and give a description of the manner of securing the eggs and the methods employed in hatching them, as it is taken for granted that all or at least most of the members present are familiar with this work, but for the benefit of those who may read the forthcoming account of the proceedings of this meeting who are not familiar with this work, I will give a brief description of the work as carried on at the different salmon stations where I have been located during the last three hatching seasons.

First, it is necessary to know something of the nature and habits of the fish in question. In most of the streams, and especially those extending long distances from the ocean, there are two runs of fish, the first occurring in March and April, and the other in July and August.

The fish coming into the streams in the first run go to the very head waters, reaching the spawning grounds late in July and August, where they remain until spent, and in fact until they die, for it is a fact not generally known that all the salmon that ascend the streams any distance above tide water, die soon after the eggs are deposited.

The second run enters the main streams about July or August. These do not ascend the stream to the distance as the first run, but they enter the small tributaries near the mouth of the main streams, they apparently being more mature on entering the stream, and in consequence seek a suitable place in which to deposit their eggs soon after leaving salt water.

The methods employed by the fish culturist in securing the eggs, is to first find some suitable location on either the main stream or some tributary, and throw a barrier across the slats



or pickets which are sufficiently close together to prevent the fish from passing between them, and high enough to preclude all danger of their jumping over, the lower end of course resting upon the bottom. This barrier prevents the fish from ascending the stream, and as it is their nature to push their way as far as there is water sufficient for them to swim in, and as they never cease the struggle and turn back, large numbers congregate just below the barrier, which is usually placed just above a deep hole where the fish lie during the ripening period before seeking the riffles and shoals upon which to spawn. Watch is then kept of the movements of the fish, and as soon as any are seen on the riffles fishing commences. The fish are taken either with a seine, or are caught in a down stream trap into which the fish are driven by going above them with a seine, and frightening them so that they make a rush down the stream and are crowded into the traps, from which they are taken and the ripe ones put into crates, where they are held for the next day's spawning. The latter method of taking the fish is preferred when the nature of the stream will admit of it. The green fish taken are always liberated, as they will not go away, and thus the fishing is continued until the spawning season is over, and practically every fish that entered the stream has been handled.

The need of carrying on this work on as large a scale as possible will be more readily understood when it is more generally known how totally lacking the salmon is in that instinct that prompts the two sexes to seek each other for the purpose of reproduction. The writer has had an excellent opportunity during three entire spawning seasons to study this trait in the salmon and never but once has he seen the two sexes together performing the functions necessary to fertilize the eggs as they are ejected by the female, and in conversing with others who have had ample opportunity for observing these fishes for years, I have never met a man who had ever seen the two sexes together at this time, as we so often see in other fishes such as the black bass, catfish, sunfishes, and many others, and for this reason it is safe to say that not one egg in one thousand is fertilized when

the fish spawn on the reefs naturally. A female will select a spot upon which to spawn, and if not disturbed will remain there, or near by, occasionally turning upon her side and with a pounding motion with her tail, and in fact with the whole body, eject a few eggs; this process is kept up at intervals of from ten minutes to half an hour or more until all her eggs have been deposited, the time consumed being from a couple of days to a week or more. The spawning always takes place in a swift current and where the bottom is gravelly, and the pounding motion spoken of loosens the gravel immediately beneath the fish; and as the current washes it from a few inches to a few feet down the stream, often a hole from one to two feet deep is thus formed, and a correspondingly large pile of gravel made just below. The eggs that have escaped are consumed by the thousands of river white fish, suckers and the several kinds of trout with which these streams abound, as the eggs and the gravel are washed down with the current together.

But where, all this time, is the male? Perhaps lying a few feet below her, or perhaps a few feet at either side, but never once approaching her. The writer has reached the conclusion that the only way in which the fertilization of the salmon egg has ever been brought about, is at those times and places where the fish are so very thick in the streams that during the light of the spawning period, the whole waters of these small streams are completely permeated with the spermatozoa of the males; and when one realizes that each large male produces a quart or more of semen during the season, it will be readily understood that large numbers of eggs could have been, and undoubtedly were fertilized in this manner. But it will be observed that the number of eggs, or the percentage rather, that are fertilized in this manner is just in proportion to the number of fish in the stream during the spawning period, and that in the streams that but few fish enter, the percentage of eggs that are fertilized is reduced in the same ratio, and as the number of salmon entering the streams is becoming less and less each season, it becomes more imperative that the work of propagation be carried on to the fullest

extent, as it is in these small streams that formerly so many fish ascended, and where at one time the chances of fertilization were enhanced by the great amount of semen ejected by the males, and that now but few ascend, rendering the chances of natural fertilization almost to the point of nil, that the work of propagating the salmon should be carried on to the fullest extent. Every stream or tributary that will yield a million or more eggs should have a sub station, and all the eggs possible taken, hatched and the fry returned to the stream, scattering them over as much territory as possible. This, in the opinion of the writer, would be a far better method, and the results in mature fish would be much greater than to have large establishments, and turn out many millions into any one stream, as each stream or portion of it has but a limited supply of the natural food suitable for the young salmon, and all in excess of the number that will live upon the food supply must necessarily perish; and as most of these streams are in a broken country where it is almost impossible to give the fry anything like a wide distribution, they must necessarily be put out over a very small area. Thus it will be readily seen that in such instances it would be an easy matter to overstock the streams, and even if none died from starvation, some would become stunted, and never reach a normal size, besides cannibalism would be encouraged; the larger and stronger ones eating the small weak ones. It has been noticed that in the past few years the number of undersized salmon that were taken were steadily on the increase, the last season showing a far greater number than any previous season. The only logical conclusion that the writer has been able to reach is that this is the result of overstocking the streams where the work of propagation is carried on to any extent, numbers of young fish being stunted for lack of sufficient food, and although they live to mature, they never grow to the normal size. This line of reasoning will undoubtedly be objected to by some on the ground that nearly all these undersized fish are males, but it is known that the fish of any one season's hatch do not reach maturity together, that is, a portion will return the third year, while another portion will

not return before the fourth season, and it is our opinion that the males mature, even if under size, and return with the regular run, while in the case of the female, she does not mature until after sufficient time has elapsed for the ova to mature, and thus she has one more season's growth than the male, and is consequently larger, on an average, although there are instances of very small females coming into the streams, and some have been taken and spawned that have weighed but from six to eight pounds and the eggs from them hatched and the fry seemed strong and healthy.

The writer is aware that this article is but a poor, crude affair, but hopes that the main idea, i. e., the need of more extended work in the propagation of this most valuable fish, has been made apparent.

DISCUSSION OF MR. DOWNING'S PAPER.

Mr. O'Malley: I didn't quite catch whether Mr. Downing limited the spawning of his fish to the blue-back salmon or to the Pacific salmon?

Mr. Clark: He refers to the quinnat salmon.

Mr. O'Malley: I should say that with the blue-black the male and female work together.

Mr. Hubbard: I have had considerable experience with the salmon, and I wish to say that the males do work with the females in spawning naturally. The female will work alone, but usually there will be one to three or four males just below, and when these males notice the female excluding the eggs they will rush up and deposit their fluid over them.

Mr. Ravenel: I think, Mr. Chairman, Mr. Hubbard is right. It is true of all other fishes and must be of the quinnat; but if not true, there would not be one-tenth of one per cent of the eggs deposited that would be fertilized. Extensive experiments have been made showing that the milt is absolutely fruitless after it has been in the water two or three minutes. I don't think there is any question at all but that two minutes is the dead line, and, in fact, one and one-half, I think, will not produce a 10 per cent fertilization.

Mr. Bryant: I would like to ask if the salmon dies after it deposits its eggs; they run up in such immense numbers, what becomes of them?

Mr. O'Malley: Near Baker, Washington, where the salmon die, they are disposed of by the bears eating them

Mr. Hubbard: I think it will be found in all spawning streams that after the salmon spawning season is over the river and shores are full of dead salmon, and you can smell them for a long ways. A great many of them float off and sink in the eddys, but it has been proven, I think, that they die after spawning.

The President: I will inquire if there is any exception in the salmon of the Pacific coast, any varieties that do not die after spawning?

Mr. Hubbard: Well, the steelheads do not die after spawning.

Mr. Ravenel: It has been a prolific source of discussion for a number of years, and a great many have been very skeptical about the salmon dying after depositing their spawn. Some have attributed it to the hardships they had to go through. But in Alaska, in the little mountain streams, the salmon at the headwaters are in as bad condition as those taken five hundred or a thousand miles up the Snake river. A captain of engineers was sent out and instructed to make a report on the Portland canal, and he found a little stream a quarter of a mile up in the mountains where the salmon were so weak they could hardly work their way up, and there were just as many wounded and dying salmon there as in the upper waters of the Sacramento or Columbia. It wasn't the distance they had gone, but their condition.

Dr. James: That is not a strong point, because the streams are very rapid and there is a great deal of exertion before the salmon gets up to where it wants to go. The streams flow so rapidly that the fish are swimming up for a long time, and it is easy to see how they get exhausted—that is, from the time they enter the stream until they spawn, and that, I think, is an injury.

The President: He was proving to you that in the streams that are not any longer than from the coast out to that shore the

salmon die after spawning just as much as after swimming thousands of miles; they find that out to be a fact that they will die anyway after they spawn, whether after undergoing the hardships of leaping falls or not.

Dr. James: I believe that is so, that some fish will die after they have performed the act; the habits of different fishes are, of course, known to those who have been observing them carefully.

Mr. Clark: I would like to ask Mr. Hubbard, as he has had much experience on the Pacific coast, if in his judgment it is something in relation to the act of spawning that kills the Pacific salmon, or is it due to their hard work reaching the spawning grounds?

Mr. Hubbard: My opinion is that the salmon arrive at their spawning grounds in fairly good condition. Of course, the longer they are in fresh water the weaker they will get, but the majority arrive in fairly good condition. The act of spawning is very exhaustive, and they are worn out, and it seems to be the nature of them to die after performing the act.

Mr. Clark: Then you are not positive that it is the work, or lack of food, or act of performing their functions, or all three combined?

Mr. Hubbard: I think it is the nature of the fish to die after spawning.

Mr. Clark: In holding whitefish in crates and in handling them in our spawning work, they receive injuries so that I don't believe three out of a hundred would live long if put back into the river. We held some of our whitefish in crates nearly two months last fall, but, of course, they had no food during that time.

Mr. Ravenel: Except that they were held in the river.

Mr. Clark: That is true; but we examined them and found nothing in their stomachs, so they didn't eat; and those fish at the end of that time were apparently in just as good condition as when put in the crates.

Mr. Davis: In regard to whitefish eating, it seems as if they did just about as well without food as with. We have a couple of whitefish weighing about two pounds apiece; I think they were

kept in an aquarium last fall and all winter, and they are in the aquarium at Paris now, and apparently in as good condition as when taken out of the river.

Mr. Clark: I don't think whitefish eat anything at all after they commence running up the river. I have never been able to find anything in their stomachs. Mr. Nevin told me last evening that he had found whitefish eggs in the stomach of a whitefish. I never have and I have examined the stomachs of thousands.

Dr. James: I think starvation is largely the cause of many of the salmon dying. The salmon will go up in great schools, and at the mouth of the more rapidly flowing streams they will accumulate in such numbers that a man can almost walk over them dry-footed; they crowd together in such a way that they injure one another, and there certainly isn't enough food for the number of fish that go there and have to await their turn to get up. Then they have to go up streams where there is a great deal of exertion required, and they must have nutrition in order to get the force to mount those rapidly flowing streams. Then they have the spawning to do, and they have to go back again, and I think starvation enters largely into that.

Mr. Hubbard: In regard to the food supply for the salmon in the streams, I wish to say that the steelheads will go up the same streams as the salmon do, and the steelheads out there are a large fish, 20 or 25 pounds; they go up as the salmon do and return to the ocean. Sometimes at our stations we put the racks in early in the spring and we sometimes catch some of those steelheads by that means; those are all returning down the stream and collect on the upper side of the racks, and I have known them to stay there all summer and then go down to the ocean in the fall, but what quinnat salmon go down all die in a few days.

Mr. Thompson: I would like to ask whether these quinnat salmon that are on their way out will take the hook?

Mr. Hubbard: I have known of a good many being caught with a hook. I don't know whether with a fly, but you can't find anything in their stomach, and I think they just bite.



Mr. Clark: I have caught the Pacific salmon in the McCloud River, as large as 24 pounds, using a red flannel rag as bait.

The President: I have a friend who has caught the salmon in one of the rivers in the State of Washington with a fly. I can't say whether they were going up to spawn or not. I want to inquire—it was spoken of here as being the nature of the fish, as though it was the nature when they spawned to die—if that was so wouldn't they all be the same size or same age? Do the fresh water conditions enter into the question of its food supply? You hear of all sizes of salmon being caught. Theorizing upon it without any practical knowledge it would seem as though some other cause than nature entered into it.

Mr. Ravenel: Why is there any more reason that salmon should be of the same size at the same age than man? You can take any number of trout fry, six months old, fed exactly the same number of times, and find some twice as large as others.

Mr. Bryant: How small do you find them when they have spawned?

Mr. Hubbard: We often find very small males; the females are generally larger; I don't know of any females with spawn in them that would weigh under six to eight pounds.

Mr. Bryant: Do the males die as well?

Mr. Hubbard: Yes. Three years ago we marked 5,000 salmon by cutting off the adipose fin, and in a little less than three years some of them were caught returning to the spawning grounds; the next year a few more were caught, and this year I understand they caught a few more of these marked salmon, so they do not all return the same year.

Mr. Bryant: Then they never spawn but once?

Mr. Morse: I would like to ask for information if both sexes die after performing the functions?

Mr. Hubbard: Yes, sir.

Mr. Thompson: I would like to have Mr. Hubbard state something in regard to the number of marked fish that returned each year, and also about the time of returning each year.



Mr. Hubbard: I am very poor to remember figures and statements, but the first year that those marked salmon were caught the cannerymen were requested to keep a record of those taken, and some thirty odd were reported, with the date of capture and weight. Since then many more have been captured, but they have kept no accurate record. I think over 100 were reported the first year they were caught, a little less than three years after they were marked and the years following I don't know the number, but some were reported.

Mr. Bryant: Whereabouts, Mr. Ravenel, do they go to in the ocean? Do they work along the shore when they get to the ocean, after being up in the fresh water, and where do they inhabit the ocean?

Mr. Ravenel: I will have to refer you to better authority.

Mr. Bryant: They are not caught in the ocean.

Mr. Ravenel: They are caught not a great distance off, very much like our shad.

Mr. Davis: Is it true that the salmon die upon their first spawning, that they never spawn but once?

Mr. Ravenel: We have only to conclude that, we don't know it, but since we assert that all the salmon that enter the rivers never return, we have got to conclude also that they never spawn but once.

Mr. Davis: What weight are the salmon when they spawn?

Mr. Hubbard: The average weight is 20 to 30 pounds.

Mr. Bryant: How long does it take them to reach that age?

Mr. Hubbard: Well, as I say, in from 3 to 4 years their weight is from 20 to 30 pounds.

The President: Are there any further remarks on the salmon, or inquiries?

Mr. Thompson: I would like to state that according to the report of the State Commissioners, the fish that were weighed ran from 12 or 15 up to 49 pounds. We are almost compelled to conclude that those fish were all the same age.

**ADDRESS OF MR. GRANT M. MORSE, STATE GAME AND FISH  
WARDEN, PORTLAND, MICH.**

---

Mr. Morse, being invited by the President to tell the Society something about his work in Michigan, said:

"I am not prepared to talk for record, but will be very glad to give you something of an idea of the work we are doing in Michigan for the protection and perpetuation of our wild life.

"Along this line I was very favorably impressed with the remarks made in one of the papers, expressing the wish that all State Commissions would work in harmony with this Society. I have enjoyed very much this meeting, and have conceived the idea that if we do work together with the protective agencies in the different states, much better work may be done by the exchange of ideas, and to that end we hope to add a little at the meeting next year at Milwaukee.

"In Michigan we have a State Fish Commission, which has to do with the propagation and planting of fishes. The propagation of the commercial fishes—whitefish and lake trout—last year, the last two years in fact, has been turned over to the U. S. Fish Commission, and the attention of the State Fish Commission has been given entirely to the inland waters. The fishes of the Great Lakes furnish food for the people of all the States, and I think it perfectly proper that the U. S. Commission should care for the work of propagating.

"The work of protection we deem in Michigan to be very important in connection with our propagating and planting, in that we are able to protect the young fishes to an age when they may be properly taken, and we deem this feature in our Great Lakes one of the most important, or really it is the main feature, that will lead to the perpetuation of the food fishes in those waters. We have fixed in our State upon a weight limit—two pounds for

whitefish and one and one-half pounds for lake trout—at which age they are supposed to reproduce themselves naturally.

“Our legislature in Michigan is much like the legislatures of other States, very careful of their appropriations, and especially for this work of protection. It requires the sentiment of the community to enforce protective laws, as it does any other law, and to get an appropriation for this work it requires a good deal of work to get them to understand the importance of such legislation. We are laboring at a good deal of disadvantage with our very small appropriation, the legislature only giving us \$2,000 for the work of protecting the Great Lakes and inland waters. We have a lake coast of nearly 2,500 miles, and very much of it is good fishing ground, and commercial fishermen are found at nearly every village along the coast. We have this whole space to look after, together with the sentimental fishes in the inland lakes, where we are bothered with dynamiters, netters and other violators, besides protecting our game in the field and forest.

“In addition to this \$2,000 we get a little revenue from our hunting license law. We have a law in our State that requires the payment by a non-resident of \$25 license for the hunting of deer, and a resident license of 75 cents. We have from this a revenue of \$4,000 or \$5,000; that makes \$6,000 or \$7,000 annually to expend. This is all the fund we have for State deputies, of which we are allowed ten, who are paid a per diem and expenses, and who work under the direction of the State Warden. In addition to this we have County Wardens, who are paid by the Boards of Supervisors, and most of you know how well County Supervisors pay wardens or others whom they are employing. But we get out of these county deputies a certain amount of work which materially aids our State men. A very few of the counties give us no aid, being against the sentiment of the work, and these vote an appropriation of only one dollar per year for county wardens. In the last five years we find that sentiment is rapidly growing for the better protection of our game and fish. In some counties, for instance, a year ago where we were unable,

with the best of evidence, to get a conviction by a jury, this year in those same counties we have not missed a conviction. Now you will see how rapidly sentiment changes in this work. In one of our counties where we have a great deal of commercial fishing, last year we had one party arrested three times for taking small fish—whitefish or lake trout—and he got clear every time. This year the first time he was arrested he was convicted and punished, and the second time convicted and punished and each time by a jury of his peers, so that we feel we have changed the sentiment in bringing before the people the necessity for this protective work for the perpetuation of our commercial fisheries.

"In taking the small fish, of course, before the age at which they reproduce, the commercial fishermen practically 'kill the goose that lays the golden egg,' while to leave them means replenished and prosperous fisheries; they cannot expect 'to reap if they do not sow.'

"This is true also of the game department. By careful protection we find our quail are increasing very rapidly from year to year. We have now a 40-days' shooting season, from the 20th of October to the 30th of November. This includes quail, partridge, wood-cock and snipe. I think we never had as many quail in the field as we had last season. They are rapidly going northward as agricultural operations have increased in that direction, and we find our quail now in plenty in Emmett County on the west shore and Cheboygan County on the east shore, but we don't get any quail in the Upper Peninsula as yet. However, deer and partridge are very plentiful in that portion of our State, holding their own in good shape.

"The work of protection, in connection with the work of fish commissions, it seems to me, should be supported, and that these two departments should always work in harmony. It was spoken of yesterday by one of the members, I think Mr. Bryant, of the Wisconsin Commission, that they were able by keeping out of protection, saying nothing about that, to get a good appropriation for propagating; I think that is right. I think the work of

propagating and distribution is a large work in itself, and if it is properly taken care of by these commissions they should look after it entirely. The work of protection is an entirely different work and produces a good deal of animosity, and perhaps this may have influenced their legislature in separating the two departments; still, having them work hand in hand with protection, for the common good, I believe is the proper way to perpetuate our fisheries and our game reservations." (Applause.)

**DISCUSSION ON THE CARE AND FEEDING OF BROOK TROUT,  
SUGGESTED BY THE TRIP TO THE EAST FREE-  
TOWN TROUT HATCHERY.**

---

The President: Yesterday you had a good opportunity to see one of the practical commercial hatcheries, and it seems to me that we fish-culturists can get more practical points from a man who is in the business to make what he can out of it than from any other source. We are fortunate in having identified with us this year more of the commercial fish-culturists than ever before. You did not have an opportunity yesterday to question Mr. Hurlbut very much, and it occurred to me that there might be some questions which you would like to ask him. I want to ask two or three questions for information. I want to ask first whether any of the fish-culturists have considered the vegetation which grows in the bottom of our ponds—I don't know the name of it, but it is very common; in many ponds it grows during the summer and then rises to the top in hot weather. Whether it is objectionable? Whether there is any preventative for it?

Mr. Root: Do you mean that green growth?

The President: That green growth. You can watch it in the summer and see it rise up, making a tunnel shaped appearance like a water-spout, and gradually cut itself off from the bottom and float on top.

Mr. Root: I had occasion, Mr. President, to inquire of one of our scientific men in Providence in regard to that very matter; he said that the vegetation would not grow in a depth of water over fourteen feet; it is only in shallow ponds that it will grow. There is no remedy for it.

The President: Well, there seems to be no one here that can give us a remedy.

Mr. Root: There is no remedy. In black bass ponds where that green matter is, black bass will not bite. On Block Island they have a great many ponds and the deepest pond they have is filled with this green scum, and you cannot catch black bass while that is there, but it doesn't last very long.

Mr. Lane: I will give you my experience, but perhaps all others have had the same. I believe in a certain measure that this growth is a good thing for trout, I think that it is a benefit, but over and above a certain amount of it I think it is an injury, and all the way I get clear of it is to keep the water as deep as I can and covered up from the sun. I believe at the same time that the fish eat a certain amount of it. I have examined and experimented with fish in ponds containing it, and they will hardly ever take but a very little artificial food and yet they will thrive perhaps better than those that are a great deal thicker and fed artificially. I believe it is a good thing, a certain amount of it.

And now while I am up I have one little point on the food of fish, and if I am wrong I wish to be corrected; if I am right I shall be glad to have given my experience. If you feed liver, I should prefer to have it the same day as killed and not after it is tainted; what I shouldn't want to eat myself I wouldn't feed to young fish. I believe food of that kind is injurious, does more harm than if it is not fed at all. After trout get to be a larger size I think that liver-fed trout is a stumbling block to many, they say they don't want to eat them; whether they have that taste or not I don't know, but most everyone says they do, and for that reason I have experimented with a food mixture that I make in this way: I take a common farmer's boiler and put in three buckets of water, then put in a pound to a pound and a half of salt, which is dissolved in the water. Then, when the water comes to a smart boiling point, I put in what is called animal meal—that is powdered and ground up fine—then add fine feed and common Indian meal, mixed—I mean shorts, only it is a different grade, a finer grade than shorts. I then cook and mix it to a state where it will be hard when cold, then force it

through a five-inch pipe with a cap on the bottom filled with holes—put the mixture into that and force the food right through the holes and make it into little worms about as large as a pipe stem. This separates it so in a few minutes it dries up enough so that when you throw it into a pool it does not crumble off, but the worms break apart and the fish will eat this about as quick as they will meat, and by putting it into that shape they don't pollute the pool with a mess of dirt. Whether the salt is a benefit to it, or whether the animal meal gives it a fine taste that the fish like, I don't know, but they thrive on that better than on liver alone. I don't know now if anybody has any better way to feed trout; if they have I should like to hear it. I came here to learn and I think I have learned, but if I can learn any more I would like to.

Mr. Ravenel: How young are the trout that you commence to feed on that?

Mr. Lane: Well, I feed the fish hatched this spring along this fall, the young fingerlings.

Mr. Ravenel: In other words, you don't use it much until they are nearly yearlings?

Mr. Lane: No, sir.

Mr. Ravenel: You know the use of mush and liver are almost universal in government stations; it is very fully described in quite a number of our publications. They start using that within two or three months after the fry commence to feed. We have never used the ground animal meal that you speak of.

Mr. Lane: Its being ground I find it digests very easily. At most of these stations don't they feed liver in large quantities?

Mr. Ravenel: They have produced some very remarkable results through feeding in that way, the fish having attained a length of eight inches within a year from the time the eggs were taken; that was an exception, of course, as the majority were not as large, but I am speaking of the exceptions.

The President: Mr. Lane, I will inquire if you don't think your meat ground up and cooked and mixed with your mush would be as well as animal meal?



Mr. Lane: I don't know but it would; I think its being ground so very fine will produce a more rapid growth than it would to take the liver raw.

Mr. Thompson: Regarding the food, I would like to state that it is to be considered according to the point of view in which you look at it. The commercial hatcheries take a very different point of view from the Commissions; they wish to grow a fish that has a very delicate flavor, and on that account they necessarily must get some food that will produce it, and of course we know that with fish as with anything else, there is a change of flavor according to the kind of food consumed. One variety of food alone I think is not the best, a change is beneficial. But in our work we are not interested in the flavor at all, we are not producing fish to turn on the market, but to plant in public waters where the natural food does the rest, and gives them that peculiar flavor that has created such an appetite for trout. So, on that account, we have no interest in getting a food with a flavor, and I think in that way our standpoint is a little different.

Then in regard to this green slime that is found in ponds, I wish to say that the Iowa station had some experience with it. In one pond, I remember, there was a sandy and gravel bottom, no loam and scarcely any vegetation, on this sandy bottom the vegetation did not take hold rapidly. Other ponds there have a loam and mud bottom where there is more or less vegetation which took hold and spread rapidly—and this slime also reproduced itself very rapidly. The fish that were placed in the pond first mentioned and spawned on the sandy bottom did not do very well. The bottom attracted the sun, there was scarcely any protection, and, as the spawning operations were visible, they were interrupted in them by other fish coming around and eating the spawn after it was extruded; the few fish hatched there found no food, and there were comparatively no results from that pond; but the other ponds that I speak of, where the bottom was covered with this vegetable growth and slime, produced good results—the fish there did well. They would select their spawning place

where it was protected from the sun and from the observation of the other fish; they were more successful in the act of spawning, and the eggs were not bothered, nor the young fry disturbed to the same extent, and when they began to eat they found apparently an abundant food supply on the vegetable growth and also on this green slime, and they did quite well. The green slime and the vegetable growth also furnish a hiding-place for the young, so that the older ones cannot pursue and attack them.

There was one statement Mr. Lane made I didn't understand. He spoke of the fish eating this slime. I would like to ask whether they eat the slime, or merely the animal growth that lives on that slime?

Mr. Lane: It may be the animal growth, but the slime disappeared.

**LACK OF FERTILIZATION VS. ARRESTED SEGMENTATION.**

---

BY J. J. STRANAHAN, BULLOCHVILLE, GA.

A series of experiments was carried on by the writer during the whitefish spawning season, with the view of discovering, if possible, what causes monster embryos in fish eggs, especially those partaking of the twin character or having more than the normal number of parts or organs.

Probably a majority of biologists hold that these monsters are occasioned by injury to the egg at certain critical periods during development. In fact, it is conceded that these monsters can be so produced artificially in the case of the chick, and doubtless others, but it is also held by some eminent embryologists that they may likely also be produced by more than one spermatozoon entering the egg through the micropyle at a time when sufficient water has entered the egg through its membranes to lift them from the disc.

The first series was carried on with a view of producing monsters by injury. For this purpose a four-ounce glass jar was used. Into this one-half ounce of eggs from a given lot were placed, when the jar was half filled with water and securely corked. It was then dropped ten times into a wooden pail half filled with water, from a height of four feet, the jar striking the bottom of the pail with considerable violence.

Lots of eggs were thus treated, beginning with the first one-half hour after the eggs were taken and impregnated, the second one hour later and then an hour up to and including the ninth lot

On examining these eggs under the microscope after they had been 48 hours in running water, only one twin disc was found, and that not very well defined, 100 eggs of each lot having been examined, showing that the injuries had not caused them in any considerable numbers.

The experiment, however, resulted in what was to the writer a most startling discovery. Five lots of one hundred each, taken from the same lot from which the eggs had been procured for these experiments, showed but 3 2-5 per cent unimpregnated eggs and but few with ruptured yolks, while those subjected to the injury process showed large numbers of what appeared to be unimpregnated, or which looked like those which fish culturists have regarded, when viewed under the microscope, as unimpregnated, the disc being hemispherical, semi-transparent, amber-colored and devoid of all appearance of segmentation. One thing is sure, all of these eggs were dead.

The following table shows the number of eggs appearing normal, that is, where segmentation had taken place, those with ruptured yolks, and those having the appearance of being unimpregnated:

	½ Hr.	1½ Hrs.	2½ Hrs.	3½ Hrs.	4½ Hrs.	5½ Hrs.	6½ Hrs.	7½ Hrs.	8½ Hrs.
Eggs, Normal.....	36	53	61	64	66	65	66	89	88
Eggs, Ruptured yolk .	57	36	27	15	12	9	8	3	3
Eggs, Unimpregnated.	7	11	12	21	22	26	26	8	9
Total .....	100	100	100	100	100	100	100	100	100
Twin Discs .....	0	0	0	0	0	0	1	0	0

It should be here stated that one twin disc was found among the five hundred eggs which had not been submitted to the injuring process.

In another experiment, eight lots of eggs were given ten shakes each with as uniform force as possible with the right arm. The results were substantially the same as in the case of the above, with the exception that there were rather more ruptured eggs than in the former case.

There is obviously but one conclusion to be drawn from the result of these experiments, and that is that the larger portion

of these eggs which seem, as viewed under the microscope, to be unimpregnated, are really fertilized, but segmentation has been arrested as a result of the injuries received; in other words, they have been killed.

If we concede this theory to be true, it then follows that many of the eggs which we have generally supposed to be unimpregnated are really those where segmentation has been stopped through injury to the disc, and since in the case of the pike perch egg this loss of ten runs up to one-fourth or even one-third of the whole, it would seem that the remedy should be sought in greater care in handling the eggs up to the point where they are fully cushioned by the absorption of water. This view was fully sustained at the Put-in-Bay station of the U. S. Fish Commission during the spawning season of 1899 in the case of several lots of pike perch eggs taken by the station force from the boats of the fishermen near by, brought to the station in the milt and manipulated with great care on the floor of the hatching room. These lots, embracing some twenty jars of eggs, hatched out from 80 to 90 per cent of fry, and were by odds the best in the house.

**THE BREEDING HABITS AND GROWTH OF THE CLAM.\***

---

BY PROFESSOR A. D. MEAD, PROVIDENCE, R. I.

In view of the deplorable decrease in the production of soft-shelled clams on the shores of Narragansett Bay, the Rhode Island Commission of Inland Fisheries two years ago requested Dr. J. L. Kellogg and myself to study the life history and habits of this most valuable shell-fish, to ascertain, if possible, the true reasons for its gradual disappearance, and to suggest a practical means either for repleting the natural clam grounds or for establishing artificial clam culture. Since then the investigations have been extended by the U. S. Fish Commission to other shores than those of Rhode Island, but to these I shall not refer in this paper. Without going into details or describing particular experiments, the general conclusions drawn from the work in Narragansett Bay may be summarized as follows:

1. The preliminary survey indicates that there are more than fifty miles of Rhode Island shore in the Bay alone which are more or less available for the rearing of clams.

2. The range and adaptability of the clams are great. They will thrive in various kinds of soil; in sand, mud, clay, and among stones; from near high-water to considerably below low water; from brackish ponds to the densely salt water of the outside shore and Seaconnet river.

3. It is the general testimony that the clams have been decreasing in quantity gradually during the last twenty years, and it is an undisputed fact that they are now comparatively scarce. The disappearance has been nearly uniform in all parts of the Rhode Island shore of the Bay; in localities protected from the wash of the steamers and not contaminated by the waste of towns, as well as in localities less fortunately situated. It is still, in certain localities, comparatively abundant below the low-tide

---

\*Received after meeting adjourned.

mark, where it cannot be taken by the ordinary method of digging, but only by the more elaborate and unusual method of churning. In Cole's river, where, under Massachusetts laws the clams are better protected, they are much more abundant than in the neighboring Rhode Island estuary, Kickemuit River, though both are similarly situated and the latter has been proved by its past history to be a locality as favorable as the other. These facts and others indicate clearly that the decrease in the clams of the State is due mainly to the unlimited and promiscuous digging and not to changed natural conditions.

4. That frequent digging up of the ground is necessary, or that it is even a positive benefit to the clams, by rendering the ground soft, is probably a fallacy. The fact that often the finest specimens are found in hard, stony ground, or in hard clay flats, which are only occasionally exposed to the clam-digger at an unusually low tide, and the observations made during the summer upon the growth of unmolested specimens, indicate that they grow well, at any rate, if left undisturbed. The habits of the animal, in obtaining food, point to the same conclusion. The food is obtained from the water which is taken in through the siphon, and not from the soil in which the clam lies. So long as it is well located, therefore, and in communication with the water it is distinctly not to its advantage to be disturbed, particularly at the risk of being buried deep under the mud or left on the surface, a prey to crabs, mummichogs, star-fish, and other enemies. Clams less than one-half an inch long will burrow very rapidly when they are exposed on the surface of the mud (if covered by water), but those upwards of three-fourths of an inch will often lie for a long time without even trying to burrow, and then are not very efficient in getting into the mud. This method of "cultivation," although undoubtedly excellent for apple trees, is not, however, equally good for clams.

5. The breeding-season of the clam is at its height in June. The exact limits of the period have not been ascertained. The eggs are extruded in great numbers into the sea-water where they are fertilized and in a short time develop into very minute

free-swimming forms with little resemblance to the adults. In this condition they live an active life and are carried hither and thither by the tides for several days at least before they settle down to the bottom or attach themselves to some object like a stone or piece of sea-weed. The obvious result of this method of reproduction is that the young clams do not remain where the eggs are laid but are very widely distributed by the tides. This fact readily explains the sudden appearance of a large set of clams in a locality where the adults are scarce. It is not at all unlikely, moreover, that the clams below tide-mark, and out of reach of their human enemy, produce a large proportion of the clams which set on the shore.

6. In the manner of setting, and in the peculiar characteristics of the young clams after they have set, there are two facts which will prove of the greatest service in clam culture. (1). The clam set is not evenly distributed even in regions of the Bay where the water is full of the free-swimming young, but in some localities the set is extremely thick while in neighboring localities, a few rods distant, only a small number may be found. (2). The young clams, from one-fourth to one-half an inch long, have a remarkable capacity for burrowing, a capacity which is greatly diminished as the animal grows larger. At the proper season, therefore, and in the localities where the set is thick, the clams can easily be collected in immense numbers by means of a sieve; and fortunately the time when they can be collected with the least difficulty happens to be the very best time for transplanting. By far the best time for collecting and transplanting is from the first week in July to the first or second week in August. It is hundreds of times easier to collect them at this season by means of a sieve than at other times of the year with a clam-hoe. There is perhaps even a greater advantage in transplanting at this time, from the fact that the clams can now be sowed broadcast like grain and will soon burrow into the sand; whereas, larger specimens from one inch upwards must necessarily be planted and carefully covered or a great loss will result. An additional fact in favor of transplanting at this time is that



in some localities there are very great quantities of young clams set early in July which, if not taken up and transplanted, are destroyed by shifting sand or from some other cause. In other localities the clams are set too thick to grow to the best advantage, and they would actually be benefited by being thinned out.

7. It seems almost certain that the explanation of the abundant set in a limited area, and the meagre set in the neighboring localities, is to be sought in the position of the shore with reference to the tides. When this explanation has been worked out in detail it may be possible artificially to construct and place apparatus to collect the set in equally large quantities.

8. The experiments of transplanting have demonstrated that under favorable conditions the rate of growth is more rapid than is usually supposed, some of the June set having reached a length of nearly two inches by the middle of September. The experiments demonstrate also, the fact that there are great differences in the rate of growth according to the food supply which is obtained from the water, and that the most rapid growth may be expected of clams which are under water most of the time.

9. The size and age at which the clam reaches sexual maturity is obviously a problem of considerable importance. It is the general opinion, and has been sometimes stated in print, that they do not spawn until the third year. That this opinion is erroneous there can be no doubt. The clams of last year set at Wickford station were ripe this year and the eggs from these specimens were artificially fertilized.

The observations from the same station indicate clearly that (1) the clams would again be abundant upon our shores could they receive, for only a few years rest from the unreasonable and promiscuous digging. (2) From the biological point of view clam culture is as practicable and feasible as oyster culture. The legislative question—the control of shore by private individuals is, to be sure, another story.

**RESPONDING TO "THE PRESS."\***

---

BY FRED J. ADAMS GRAND RAPIDS MICH.

Gentlemen of the American Fisheries Association—When I was asked by your secretary, Seymour Bower, to prepare something for your annual meeting, I threw up my hands. I do pretend to know something about brook trout and rainbow trout, but for me to pretend to tell or write anything interesting for members of your Association, seemed beyond my ability. I could write fish stories until the cows come home, and I could describe the delights of Michigan streams until you all grew weary of listening, but I don't know that I could give you a single new thought or idea upon the great subject with which you are all so well familiar. Mr. Bower spoke of the benefits of artificial propagation and planting in public waters, but it would be a dry subject. It is a conceded subject to begin with. Everybody who knows anything at all about fish or fisheries knows that no question mark can be put after any of our hatcheries or their work, and the man who would attempt to deliver himself upon the benefits of artificial propagation or subsequent planting, would be like a man who attempted to descant upon the benefits of the joyous hereafter.

There is one feature of the subject, however, which we can all of us consider. It refers to The Press. This sentiment has been responded to so often and so completely in all the varied forms that ingenuity can devise, that it is with some little fear and trepidation that I attempt to give you anything new upon the subject. And yet, there is a very decidedly new feature so far as fish and fishermen are concerned.

The newspaper of to-day is admitted to be the great educator of the masses. It creates sentiment favorable and unfavorable. It educates the people upon all topics of interest upon which the writers themselves are posted. And yet how few of

---

\*Received after meeting adjourned.

our newspapers to-day ever publish anything reliable or readable upon the subject of inland fishing. I know nothing about the deep sea fishing or the sport to be found along the coast, but I do know and realize full well that few of the writers for our newspapers of to-day have any real conception of the delights and the experiences of inland fishing, especially of brook trout. We read descriptions which no doubt please the greaat masses of the people very well, and we read stories which to the tenderfeet sound well enough. We read in magazines of great catches being made under conditions quite as harrowing or as romantic to the ordinary reader as they are amusing to the old timer, and they are published in all good faith, too. It was but a few weeks ago that one of the metropolitan papers referred to a man "sitting upon a log in the middle of the stream fishing for trout," and another very excellent newspaper recently contained a Sunday story about two trout fishermen who "waded upstream until they were all worn out, in the search for speckled beauties." Similar reference might also be made to many of the illustrations, intended to show scenes and incident upon trout streams. They picture whiskered gentlemen with the inevitable English outing cap, a briar pipe, double-breasted jackets and top boots, and the fisherman is usually using a long and well bent rod from the bank or standing in very shallow water. Of course, many fishermen smoke briar pipes, and many of them fish from the bank, but every trout fisherman knows that the picture is by no means true to nature.

The trouble is that there are so few of the newspaper men who know anything about the sport. In our busy life we have little time for such things. When an editor or reporter gets a little time for rest and relaxation he goes to put it in along lines familiar to him, and few of us have apparently had the opportunity to become acquainted with the delights and the very substantial benefits of a day or a week upon the trout stream. The members of your Association can do some missionary work in this field with promise of certain and satisfactory results. I know this from my own experience.

Michigan is one of the best states for trout fishing in the country. We who are fortunate enough to live here, are just a little conceited of our resources in this respect. Years ago we had grayling in abundance but in the absence of successful artificial propagation they have disappeared so rapidly as to become practically extinct in Michigan waters. Under the magnificent work of the State Fish Commission, the number of trout streams have multiplied until almost every little brook is a trout stream. The number of fishermen has increased in the same proportion, too. A few years ago the trout fishermen who were really enthusiasts, were few in number, while the fly fishermen of the state could almost be counted upon the fingers. To-day there are thousands in the state and practically all of them use the fly. In Grand Rapids there is a fishing club of over four hundred members, each of whom uses the fly practically altogether, and the membership of this club is but a small percentage of the total number of good fishermen.

But to return to the subject! Of all my own acquaintance among the newspaper workers of Michigan I do not know of one who takes any personal interest in trout fishing. There are bass fishermen, yachtsmen, oarsmen and experts in other lines, but I cannot recall having met an active newspaper man from this or any other state, either upon the stream or upon the conversational fishing stream. I probably would have remained in the dark myself had it not been for one of your members, "Uncle" Horace W. Davis, president of our State Fish Commission. It was seven years ago when he induced me to go upon a little one-day trip to a stream forty miles north of the city. A borrowed outfit was easily obtained and upon the return I could not get to the store quickly enough to buy one of my own. I was green at the game but I learned. I caught but few fish but Davis landed enough for both and I came home with an enthusiasm which has never diminished. Piece by piece the outfit has been purchased until now it is as complete as my needs seem to require, and I am no longer a borrower of rods or waders, but am in a position

to lend and to divide up with the less experienced or less fortunate on the return trip.

You gentlemen can do for others what Davis did for me. You can get newspaper workers interested in the great sport which we all so thoroughly enjoy. Speaking from an experience of fifteen years I can promise you that you will find them as royal a lot of men as ever cast a fly and with the true sportsman-like feeling awaiting only cultivation and development. They will not be looking for the best end of it either. In olden days it was a tradition that newspaper men were continually looking for something free. It is not so to-day. They would thoroughly enjoy plenty of God's own free sunlight and fresh air, and the freedom from care and restraint so characteristic of the stream, and they would enjoy meeting the free heartedness and the freemasonry always known among fishermen, and the tenderfeet will need plenty of free advice and instruction, but beyond that you will have no cause for worry.

I think you will see the point I wish to make. The newspapers are the educators; then why not all turn in and educate the newspapers. We are all interested in trout fishing and in the preservation of our streams. In order that the streams are restocked, artificial propagation is necessary, and this costs money. Legislatures must vote the money and in order to do this they must have the people behind them. In order to get the people, we must have the newspapers, and there is no better way under the sun than to make the men who make the newspapers thoroughly acquainted by actual contact with the situation.

**LIST OF MEMBERS.**

---

**ACTIVE.**

---

- ADAMS, E. W., 114 Wall st., New York.  
ADAMS, FRED J., Grand Rapids, Mich.  
AINSWORTH, C. E., Sault Ste. Marie, Mich.  
ALLEN, G. R., Roxbury, Vt.  
ALEXANDER, GEORGE L., Grayling, Mich.  
ALEXANDER, L. D., 50 Broadway, New York.  
ANDERSON, J. F., 240 Eleventh st., Jersey City, N. J.  
ANDREWS, A., Columbus, Ga.  
ANNIN, JAMES, JR., Caledonia, N. Y.  
ATKINS, CHAS. G., East Orland, Me.  
AYER, F. W., Bangor, Me.  
  
BABBITT, A. C., Williamsburg, Mich.  
BAILEY, H. W., Newbury, Vt.  
BALL, E. M., Leadville, Colo.  
BARRETT, W. W., Church's Ferry, N. D.  
BARTLETT, DR. S. P., Quincy, Ill.  
BELL, CURRIE G., Bayfield, Wis.  
BELMONT, HON. PERRY, 19 Nassau st., New York.  
BENKARD, JAMES, Union Club, New York.  
BENNETT, S. R., New Bedford, Mass.  
BENTON, W. H., Bullochville, Ga.  
BICKMORE, PROF. A. S., Seventy-seventh st. and Eighth ave., New York.  
BIRGE, PROF. E. A., Madison, Wis.  
BISSELL, JOHN H., Detroit, Mich.  
BLACKFORD, HON. EUGENE G., Fulton Market, New York.  
BLATCHFORD, E. W., Chicago, Ill.  
BOOTH, A., 36 State st., Chicago, Ill.  
BOTTEMANNE, C. J., Bergen op Zoom, Holland.  
BOWERS, HON. GEORGE M., U. S. COMMISSIONER OF FISHERIES, Washington,  
D. C.  
BOWER, SEYMOUR, Detroit, Mich.  
BOWER, WARD T., Detroit, Mich.  
BOWMAN, W. H., Rochester, N. Y.  
BOYCE, F. C., Carson City, Nev.  
BRADLEY, DR. E., 19 West Thirteenth st., New York.  
BREWER, W. C., Cleveland, O.  
BREWSTER, C. E., Grand Rapids, Mich.  
BREWSTER, W. K., Durand, Mich.  
BROWN, GEORGE M., Saginaw, Mich.

- BRUSH, DR. E. F., Mount Vernon, N. Y.  
BRYANT, GEN. E. E., Madison, Wis.  
BULKLEY, H. S., Odessa, N. Y.  
BULLARD, C. G., Kalamazoo, Mich.  
BUMPUS, DR. H. C., Providence, R. I.  
  
CARLO, G. POSTIGLIONE DE, Naples, Italy.  
CHAMBERS, A. E., Kalamazoo, Mich.  
CHASE, H. C., 1020 Arch st., Philadelphia, Pa.  
CHENEY, A. N., Glens Falls, N. Y.  
CLARK, FRANK N., Northville, Mich.  
COBB, E. W., St. Johnsbury, Vt.  
COGSWELL, J. M., U. S. FISH COMMISSIONER, Washington, D. C.  
COHEN, N. H., Urbana, Ill.  
COLLINS, HON. J. C., Providence, R. I.  
CORLISS, C. S., Gloucester, Mass.  
COULTER, A. L., Charlevoix, Mich.  
CROOK, ABEL, 99 Nassau st., New York.  
CROSBY, H. F., 30 Broad st., New York.  
CURTIS, J. M., Cleveland, O.  
  
DALE, J. A., York, Pa.  
DAVIS, HORACE W., Grand Rapids, Mich.  
DAVIS, B. H., Palmyra, N. Y.  
DAVIS, HON. GEORGE B., Utica, Mich.  
DEMUTH, H. C., 144 E. King st., Lancaster, Pa.  
DE ROCHER, JAS. D., Nashua, N. H.  
DICKERSON, FREEMAN B., Detroit, Mich.  
DINSMORE, A. H., Green Lake, Me.  
DOUREDURE, B. L., 103 Walnut st., Philadelphia, Pa.  
DOWNING, S. W., Put-in-Bay, O.  
DOYLE, E. P., Port Richmond, N. Y.  
DUNLAP, I. H., U. S. FISH COMMISSION, Washington, D. C.  
  
EBEL, HON. F. W., Harrisburg, Pa.  
EDWARDS, VINAL N., Woods Hole, Mass.  
ELLIS, J. FRANK, U. S. FISH COMMISSION, Washington, D. C.  
  
FEARING, HON. D. B., Newport, R. I.  
FILKINS, B. G., Northville, Mich.  
FOX, CAPT. J. C., Put-in-Bay, O.  
FRIESMUTH, E. H., JR., 151 North Third st., Philadelphia, Pa.  
FROTHINGHAM, H. P., Mount Arlington, N. J.  
  
GAVITT, W. S., Lyons, N. Y.  
GEER, E. H., Hadlyme, Conn.  
GEORGE, HON. A. F., Swanton, Md.  
GREENE, MYRON, Franklin, Vt.  
GRIFFITH, S. L., Danby, Vt.  
GUNCKEL, JOHN E., Toledo, O.

- HAGERT, EDWIN, 32 North Sixth st., Philadelphia, Pa.  
HAHN, CAPT. E. E., Woods Hole, Mass.  
HALEY, CALEB, Fulton Market, New York.  
HAMILTON, ROBERT, Greenwich, N. Y.  
HAMSDALE, FRANK, Madison, Wis.  
HANDY, L. B., South Wareham, Mass.  
HANSEN, G., Osceola Mills, Wis.  
HARRIS, J. N., Fulton Market, New York.  
HARTLEY, R. M., 627 Walnut st., Philadelphia, Pa.  
HENSHALL, DR. JAMES A., Bozeman, Montana.  
HILL, JOHN L., 115 Broadway, New York.  
HOGAN, J. J., Madison, Wis.  
HOLDEN, H. S., Syracuse, N. Y.  
HOXIE, CHAS. A., Carolina, R. I.  
HOXIE, J. W., Carolina, R. I.  
HUBBARD, WALDO F., Nashua, N. H.  
HUGHES, FRANK L., Ashland, N. H.  
HUNSAKER, W. J., Detroit Mich.  
HUNTINGTON, L. D., New Rochelle, N. Y.  
HURLBUT, H. F., East Freetown, Mass.  
HUTCHINSON, E. S., Washington, D. C.
- JAMES, DR. BUSHROD W., n. e. cor. Eighteenth and Green sts., Philadelphia, Pa.
- JENNINGS, G. E., *Fishing Gazette*, 203 Broadway, New York.  
JENSEN, PETER, Escanaba, Mich.  
JOHNSON, S. M., Union Wharf, Boston, Mass.  
JONES, ALEXANDER, Erwin, Tenn.  
JONES, DR. O. L., 116 West Seventy-second st., New York.  
JOSEPH, D., Columbus, Ga.
- KAUFFMANN, S. H., *Evening Star*, Washington, D. C.  
KELLY, P., 346 Sixth ave., New York.  
KENYON, A. W., Usquepaugh, R. I.  
KERR, CAPT. J. R., Pittsburgh, Pa.  
KIEL, W. M., Tuxedo Park, N. Y.
- LAMKIN, J. BAYARD, Bullochville, Ga.  
LANE, GEORGE F., Silver Lake, Mass.  
LAWTON, COL., J. P., Columbus, Ga.  
LEACH, G. C., 3923 Finney ave., St. Louis, Mo.  
LOCKE, E. F., Woods Hole, Mass.  
LOVEJOY, SAMUEL, Bullochville, Ga.  
LYDELL, DWIGHT, Mill Creek, Mich.
- MCGOWAN, HON. H. P., 108 Fulton st., New York.  
MALLORY, CHAS., Burling Slip, New York.  
MANCHA, H. H., Northville, Mich.  
MANNING, W. W., Marquette, Mich.



- MANSFIELD, H. B., LIEUT.-COM., U. S. NAVY, 368 Hancock st., Brooklyn, N. Y.
- MANTON, DR. W. P., Detroit, Mich.
- MARKS, H. H., Sault Ste. Marie, Mich.
- MARKS, J. P., Paris, Mich.
- MARSH, W. C., Washington, D. C.
- MATHEWSON, G. T., Thompsonville, Conn.
- MAY, W. L., Omaha, Neb.
- MEAD, PROF. A. D., Brown University, Providence, R. I.
- MEEHAN, W. E., *Public Ledger*, Philadelphia, Pa.
- MERRITT, F. H. J., Altamont, N. Y.
- MERRILL, M. E., St. Johnsbury, Vt.
- MILLER, GEO. F., Put-in-Bay, O.
- MILLER, W. S., Gallion, O.
- MILLIKEN, DR. J. D., U. S. FISH COMMISSION, Woods Hole, Mass.
- MILLS, G. F., Carson City, Nev.
- MOORE, CHAS. H., Detroit, Mich.
- MORGAN, H. A., Baton Rouge, La.
- MORRELL, DANIEL, Hartford, Conn.
- MORSE, GRANT M., Portland, Mich.
- MORTON, W. P., Providence, R. I.
- MOSHER, STAFFORD, Fort Plain, N. Y.
- MUSSEY, GEORGE D., Detroit, Mich.
- NASH, DR. S. M., 63 West Forty-ninth st., New York.
- NEVIN, JAMES, Madison, Wis.
- OBERFELDER, R. S., Sidney, Neb.
- O'BRIEN, W. J., South Bend, Neb.
- O'CONNOR, E. M., Savannah, Ga.
- O'HAGE, DR. JUSTUS, St. Paul, Minn.
- O'MALLEY, HENRY, Baker, Washington.
- ORR, W. J., Bay Port, Mich.
- OSBORN, WM., Duluth, Minn.
- PAGE, P. W., West Summit, N. J.
- PARKER, DR. J. C., Grand Rapids, Mich.
- PEABODY, GEORGE A., Appleton, Wis.
- PECK, HON. STEPHEN, Warren, R. I.
- POWELL, W. L., Harrisburg, Pa.
- POWERS, J. A., Lansingburg, N. Y.
- POWERS, JOHN W., Big Rapids, Mich.
- PRATHER, J. HUB, Lexington, Ky.
- PRESTON, HON. JOHN L., Port Huron, Mich.
- PRESTON, DR. HENRY G., 98 Lafayette Square, Brooklyn, N. Y.
- PROCTOR, HON. REDFIELD, Proctor, Vt.
- RATHBONE, WM. F., D. & H. R. R., Albany, N. Y.
- RATHBUN, RICHARD, Smithsonian Institution, Washington, D. C.
- RAVENEL, W. DE C., U. S. FISH COMMISSION, Washington, D. C.

- REIGHARD, PROF. JACOB E., U. of M., Ann Arbor, Mich.  
RICHARDS, G. H., Boston, Mass.  
ROBERTS, A. D., Woonsocket, R. I.  
ROBINSON, W. E., Mackinaw City, Mich.  
ROBINSON, A. H., St. Johnsbury, Vt.  
RODGERS, FRANK A., Grand Rapids, Mich.  
ROGERS, J. M., Chicago, Ill.  
ROOT, HENRY T., Providence, R. I.  
ROSENBERG, ALBERT, Kalamazoo, Mich.  
RUGE, JOHN G., Apalachicola, Fla.  
RUSSEL, HENRY, Detroit, Mich.
- SCHWEIKART, WALTER, Detroit, Mich.  
SEAGLE, GEO. A., Wytheville, Va.  
SELF, E. M., Bullochville, Ga.  
SELLERS, M. G., Philadelphia, Pa.  
SEXTON, CRAMER, Murfreesboro, Tenn.  
SHERWIN, H. A., 100 Canal st., Cleveland, O.  
SMITH, L. H., Algona, Iowa.  
SMITH, DR. HUGH M., U. S. FISH COMMISSION, Washington, D. C.  
SMITH, CAPT. J. A., Woods Hole, Mass.  
SOLMANS, ALDEN, South Norwalk, Conn.  
SOUTHWICK, J. M. K., Newport, R. I.  
SPENSLEY, CALVERT, Mineral Point, Wis.  
STARBUCK, ALEXANDER, Cincinnati, O.  
STARR, W. J., Eau Claire, Wis.  
STELLE, G. F., Chicago, Ill.  
STERLING, J. E., Crisfield, Md.  
STEWART, CHAS. E., Westerly, R. I.  
STEWART, A. T., Northville, Mich.  
STONE, LIVINGSTON, Cape Vincent, N. Y.  
STRANAHAN, J. J., Bullochville, Ga.  
STRANAHAN, F. A., Cleveland, O.  
STRANAHAN, F. F., Cleveland, O.  
STRANAHAN, H. B., Cleveland, O.  
SYKES, ARTHUR, Madison, Wis.  
SYKES, HENRY, Bayfield, Wis.
- TAWES, J. C., Crisfield, Md.  
TAYLOR, A. R., 318 Main st., Memphis, Tenn.  
THAYER, W. W., 234 Joseph Campau ave., Detroit, Mich.  
THOMPSON, CARL G., 78 Henry st., Huntington, Ind.  
THOMPSON, W. T., Nashua, N. H.  
THOMPSON, W. P., 1020 Arch st., Philadelphia, Pa.  
TINKER, E. F., St. Johnsbury, Vt.  
TITCOMB, JOHN W., St. Johnsbury, Vt.  
TRUMPOUR, D. A., Bay City, Mich.  
TUBBS, FRANK A., Neosho, Mo.

- TUCKER, EDMUND ST. GEORGE, Bedford Row, Halifax, N. S.  
TULIAN, EUGENE A., Leadville, Colo.  
VAN CLEEF, J. S., Poughkeepsie, N. Y.  
VINCENT, W. S., Leadville, Colo.  
VOGELSANG, ALEXANDER T., Mills Building, San Francisco, Cal.  
WALKER, BRYANT, Detroit, Mich.  
WALLETT, W. H., Put-in-Bay, O.  
WALTERS, C. H., Cold Spring Harbor, N. Y.  
WALTON, C. H., 1713 Spring Garden st., Philadelphia, Pa.  
WARD, PROF. H. B., Lincoln, Neb.  
WEBB, W. SEWARD, Forty-fourth st. and Vanderbilt ave., New York.  
WENTWORTH, NATHANIEL, Hudson Centre, N. H.  
WEED, W. R., Potsdam, N. Y.  
WETHERBEE, W. C., Port Henry, N. Y.  
WHITE, R. TYSON, 320 Bridge st., Brooklyn, N. Y.  
WILBUR, H. O., 235 Third st., Philadelphia, Pa.  
WILBUR, P. H., Little Compton, R. I.  
WILLARD, CHAS. W., Westerly, R. I.  
WILLETTTS, J. C., 40 Wall st., New York.  
WILLIAMS, J. A., St. Johnsbury, Vt.  
WILSON, S. H., Cleveland, O.  
WINN, DENNIS, Nashua, N. H.  
WIRES, S. P., Lester Park, Duluth, Minn.  
WOOD, C. C., Plymouth, Mass.  
ZALSMAN, PHILIP G., Paris, Mich.  
ZWEIGHAPT, S., Deer Park, Haines Falls, N. Y.

HONORARY.

- BORODINE, NICHOLAS, Delegate of the RUSSIAN ASSOCIATION OF PISCICULTURE AND FISHERIES, Uralsk, Russia.  
FISH PROTECTIVE ASSOCIATION OF EASTERN PENNSYLVANIA, 1020 Arch st., Philadelphia, Pa.  
LAKE ST. CLAIR SHOOTING & FISHING CLUB, Detroit, Mich.  
NEW YORK ASSOCIATION FOR THE PROTECTION OF FISH AND GAME, New York City.  
SOUTHSIDE SPORTSMEN'S CLUB, Oakdale, L. I., N. Y.  
SWEENEY, DR. R. O., Lester Park, Duluth, Minn.  
THE PRESIDENT OF THE UNITED STATES.  
THE GOVERNORS OF THE SEVERAL STATES.  
WOODMONT ROD AND GUN CLUB, Washington, D. C.

## CORRESPONDING.

- APOSTOLIDES, PROF. NICOLY CHR., Athens, Greece.  
 ARMISTEAD, J. J., Dumfries, Scotland.  
 BENECKE, PROF. B., COMMISSIONER OF FISHERIES, Königsberg, Germany.  
 BIRBECK, EDWARD, ESQ., M. P., London, England.  
 BRADY, THOS. F., ESQ., INSPECTOR OF FISHERIES, Dublin Castle, Dublin, Ireland.  
 FEDDERSEN, ARTHUR, Copenhagen, Denmark.  
 GIGLIOLI, PROF. H. H., Florence, Italy.  
 ITO, K., MEMBER OF FISHERIES DEPARTMENT OF HOKKAIDO and PRESIDENT OF THE FISHERIES SOCIETY OF NORTHERN JAPAN, Sapporo, Japan.  
 JAFFA, S., Osnabruck, Germany.  
 JUEL, CAPT. N., R. N., PRESIDENT OF THE SOCIETY FOR THE DEVELOPMENT OF NORWEGIAN FISHERIES, Bergen, Norway.  
 LANDMARK, A., INSPECTOR OF NORWEGIAN FRESH WATER FISHERIES, Bergen, Norway.  
 LUNDBERG, DR. RUDOLPH, INSPECTOR OF FISHERIES, Stockholm, Sweden.  
 MACCLEAY, WILLIAM, PRESIDENT OF THE FISHERIES COMMISSION OF NEW SOUTH WALES, Sydney, N. S. W.  
 MAITLAND, SIR JAMES RAMSAY GIBSON, BART., Howieton, Stirling, Scotland.  
 MALMGREN, PROF. A. J., Helsingfors, Finland.  
 MARSTON, R. B., ESQ., EDITOR OF THE *Fishing Gazette*, London, England.  
 OLSEN, O. T., Grimsby, England.  
 SARS, PROF. G. O., GOVERNMENT INSPECTOR OF FISHERIES, Christiania, Norway.  
 SENIOR, WILLIAM, London, England.  
 SMITT, PROF. F. A., Stockholm, Sweden.  
 SOLA, DON FRANCISCO GARCIA, SECRETARY OF THE SPANISH FISHERIES SOCIETY, Madrid, Spain.  
 SOLSKY, BARON N. DE, DIRECTOR OF THE IMPERIAL AGRICULTURAL MUSEUM, St. Petersburg, Russia.  
 TRYBOM, DR. FILIP, Stockholm, Sweden.  
 WALPOLE, HON. SPENCER, GOVERNOR OF THE ISLE OF MAN.  
 WATTEL, M. RAVERET, SECRETARY OF THE SOCIÉTÉ D'ACCLIMATATION, Paris, France.  
 YOUNG, ARCHIBALD, ESQ., INSPECTOR OF SALMON FISHERIES, Edinburgh, Scotland.

## RECAPITULATION.

Active .....	244
Honorary .....	53
Corresponding .....	26
Total membership.....	323

# CONSTITUTION.

(As amended to date.)

---

## ARTICLE I.

### NAME AND OBJECTS.

The name of this Society shall be American Fisheries Society. Its objects shall be to promote the cause of fish-culture; to gather and diffuse information bearing upon its practical success, and upon all matters relating to the fisheries; the uniting and encouraging of all the interests of fish-culture and the fisheries, and the treatment of all questions regarding fish, of a scientific and economic character.

## ARTICLE II.

### MEMBERS.

Any person shall, upon a two-thirds vote and the payment of one dollar, become a member of this Society. In case members do not pay their fees, which shall be one dollar per year, after the first year and are delinquent for two years, they shall be notified by the Treasurer, and if the amount due is not paid within a month thereafter, they shall be, without further notice, dropped from the roll of membership. Any person can be made an honorary or a corresponding member upon a two-thirds vote of the members present at any regular meeting.

Any person shall, upon a two-thirds vote, and the payment of \$15.00, become a life member of this Society, and shall thereafter be exempt from all annual dues.

## ARTICLE III.

## OFFICERS.

The officers of this Society shall be a President and a Vice-President, who shall be ineligible for election to the same office until a year after the expiration of their term; a Corresponding Secretary, a Recording Secretary, a Treasurer and an Executive Committee of seven, which, with the officers before named, shall form a council and transact such business as may be necessary when the Society is not in session, four to constitute a quorum.

## ARTICLE IV.

## MEETINGS.

The regular meeting of the Society shall be held once a year, the time and place being decided upon at the previous meeting or, in default of such action, by the Executive Committee.

## ARTICLE V.

## CHANGING THE CONSTITUTION.

The Constitution of the Society may be amended, altered or repealed by a two-thirds vote of the members present at any regular meeting, provided at least fifteen members are present at said meeting.

